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ABSTRACT

This document presents the proceedings of the 24th annual National Convention of the Association for Educational Communications and Technology (AECT) (Atlanta, Georgia, 2001). The proceedings is published in two volumes. Volume 1 contains papers dealing primarily with research and development topics. Papers dealing with instruction and training issues are contained in volume 2, which has over 60 papers. Topics include: professional development and teacher education; educational technology; computer mediated communication; cooperative programs; computer uses in education; technology integration; instructional design; distance education; interface design; instructional innovation; students' and teachers' reactions to technology-based programs; student motivation; partnerships in education; evaluation of instructional methods; learner-centered instruction; use studies; case studies; online communities; instructional material development; and Web-based programs. (AEF)

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Annual Proceedings of Selected Research and Development [and] Practice Papers Presented at the National Convention of the Association for Educational Communications and Technology (24th, Atlanta, Georgia, November 8-12, 2001). Volumes 1-2

Margaret Crawford, Michael Simonson, and Carmen Lamboy, Editors

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2001 Annual Proceedings - Atlanta: Volume #1

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Preface

For the twenty-fourth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. Papers published in this volume were presented at the National AECT Convention in Denver, CO. A limited quantity of these Proceedings were printed and sold in both hardcopy and electronic versions. It is also available on microfiche through the Educational Resources Clearinghouse (ERIC) system.

The Proceedings of AECT's Convention are published in two volumes. Volume #1 contains papers dealing primarily with research and development topics. Papers dealing with instruction and training issues are contained in volume #2, which also contains over 60 papers.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately fifty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

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Web Usability Test Findings and Analysis Issues

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Abstract

In this paper, we discuss findings and data analysis issues that resulted from a case usability test. The findings relate to the generation of design ideas. Through usability test, it was found that users have a somewhat unified viewpoint regarding the menus on the side areas of a web page. They tend to view them as a "quick" way to access "specific" and "frequently searched" information. The analysis issues are concerned with analyzing task completion rate, time taken, and path taken to finish the tasks. When analyzing these measures, the researcher needs to consider nature of the web site, portal site in this case usability test, rather than simply looking at whether and how the test participants found the answer.

Introduction

This paper discusses findings and analysis issues derived from a lab usability test. The procedure of conducting a lab usability test is pretty much standardized and there are standard sets of data typically collected in web site tests such as, task completion rate, time taken, paths taken, and verbal protocol. The analysis of the data, however, varies widely depending on the case. When analyzing usability test data, it is important to consider the nature of the web site. Depending on the nature of the site, the same data can be analyzed differently resulting in different usability indices. In addition, it is well-known in the usability literature that deriving design ideas from usability test data is a difficult task. Generating design ideas is closely related to how the researcher analyzes test data. This paper describes and discusses how a web design team considered the nature of the portal site in data analysis and derived design ideas by distilling data into a finding and the finding into design ideas.

Redesign of a University Web Site

The case usability test this paper derives data from was conducted as a part of redesign project that aimed to update the existing home page of Indiana University Bloomington (IUB) [2]. The home page contained links to the web sites that various institutions in the university had already created. Therefore, it functioned as a portal to various web sites and employed hierarchical menu structure.

It was acknowledged that the site had a high degree of usability because a group of graduate students in the university conducted a user-centered design research and applied the research results when designing the site in 1995 [1]. Although usable, there occurred several reasons to redesign the site. First of all, it was reported that prospective students look at universities' home pages a lot when they consider applying for schools. Keeping the site up-to-date was important in the view of the university's marketing strategy. In addition, information organization of the site was getting messy as the site was accommodating publication requests from various institutions in the university over the years. For example, some pages had too many links and some links were not placed in the page where users would expect to see them. Finally, there has been a consistent request that the site should enhance its visual aspects. With these reasons, IUB Web team began a redesign project in January, 2000 with an emphasis on user-centered design principle.

As the first step of the redesign effort, the design team created a preliminary prototype outlining link categorization only and tested usability of the link categorization. Then, the team produced second prototype where they incorporated results of the usability test and included visual elements. Although the link categorization was assumed to be usable, the team conducted another bigger scale usability evaluation on the second prototype to ensure usability of the overall prototype. Usability evaluation on the second prototype had various goals. In addition to collecting general usability measures such as task completion rate, time taken to complete the tasks, and the links chosen to complete the tasks, the evaluation aimed to measure effectiveness of new navigation features and hear users' opinion about the site in general and visual design in specific. It also targeted to assess accessibility and speed of the site. To achieve such various goals, it was necessary to use various test methods such as a lab usability test, heuristics evaluations, a web-based survey, foreign font display check, and page loading speed check.

Lab Usability Test

The findings and analysis issues discussed in this paper resulted mainly from the lab usability test. The lab test employed typical usability test methodology. Participants were selected through purposeful sampling. Nine users of the current IUB home page were recruited as test participants considering their occupation, web use, gender, and nationality. In the test, the participants were asked to perform eleven tasks using either the new prototype or the existing web site. Through random assignment, participants 1, 3, 4, 5, and 9 were asked to use the new prototype, whereas 2, 6, 7, and 8, the existing site. Through the eleven tasks, participants were asked to search for typically and frequently searched information in IUB site. The tasks also required the participants to use new navigational features and menu structures. Throughout the test, participants were asked to think out loud. The test administrator observed the test session collecting performance measures such as task completion, time taken, and paths taken as well as the participants' comments and emotional expressions. She sometimes prompted and probed think-aloud, and responded to the user's task-related questions. The whole test sessions were videotaped for later review. After the usability test, a debriefing interview was conducted. The test administrator solicited further comments about the events during the test that she did not understand. In addition, she asked for comments about the web site in general and any suggestions for improvement.

Data Analysis Considering Nature of the Portal Site

Task completion rate, time taken, and paths chosen to complete the tasks are three classical usability measures. Typically, successful completion is considered to be the point when the participant finds the answer. The time taken and the links chosen till the completion point are typically analyzed. Such typical way of analysis, however, didn't seem to work well in the IUB web site test. As the target site of the test was a portal site providing links to various external web sites, it was inevitable for the participants to use sites other than the target site (i.e., external sites) in order to finish the tasks. Indeed, some users spent much time looking at external pages. Some failed to find the answers due to the design problems of the external sites. Simply looking at whether the participant had found the answer or not, and counting total time taken didn't seem to be appropriate measurements. After several rounds of discussion, the team decided to make a distinction between the use of IUB home pages and the use of other sites and collect the three measures during the use of IUB home pages only.

Task Completion

In the case of task completion rate, the team decided to consider that a participant completed a task successfully if she found the link leading to the external site containing the answer (i.e., correct link), regardless she found the answer or not. The fact that the user had found the correct link was assumed to indicate that the link categorization in IUB site was effective enough for the user to get to the right place, which was the main goal of the site. If the user failed to find the answer after getting to the correct page, it was due to the poor design of the external page, which was beyond the goal of the re-design project. Table 2.1 summarizes task completion rate following this analysis decision. If the user found the correct page but failed to find the answer, it was indicated as f/s and counted as a success rather than a fail. Table 2.2 summarizes task completion rate by just considering whether the user found the answer or not. Note the difference in the number of people completed the task successfully between the two tables. T test result on the difference was t = 1.884, df=10, p=.089. Considering small sample size, the difference was almost significant.

<Table 2.1> Task completion rate considering the use of IUB site only

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	s	s	s	s	s	s	s	f/s	s	s	s
s3	s	s	s	s	s	s	s	f/s	s	s	s
s4	s	s	f/s	s	f	f/s	s	f	s	s	s
s5	s	s	f/s	s	s	s	s	f	s	s	s
s9	s	s	f/s	s	s	f/s	s	f	s	s	s
No. of people completed the task successfully	5	5	5	5	4	5	5	2	5	5	5

s: success
f: fail
f/s: the user found the correct page but could not find the information due to the poor design of external sites

<Table 2.2> Task completion rate considering the use of not only IUB site but also external site

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	s	s	s	s	s	s	s	f	S	s	s
s3	s	s	s	s	s	s	s	f	S	s	s
s4	s	s	f	s	f	f	s	f	S	s	s
s5	s	s	f	s	s	s	s	f	S	s	s
s9	s	s	f	s	s	f	s	f	S	s	s
No. of people completed the task successfully	5	5	2	5	4	3	5	0	5	5	5

Time Taken

In the case of the time taken to finish the tasks, the team decided to count the time spent before the users found the correct external site for the first time. Here, the word "for the first time" is important because several occasions occurred where users found the correct external site initially but could not find the answer in the site. Then, they went back to IUB site, tried other external sites, and went back to the correct site which they looked at previously and found the answer eventually. In this case, the time taken to find the correct external site for the first time seemed to be an accurate measure of the effectiveness of the link categorization. Table 3.1 summarizes time taken to find the correct external page for the first time whereas Table 3.2, total time taken to finish the tasks. The mean time taken is significantly (t= -4.318, df=10, p=.002) different depending on the two different ways of counting time.

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<Table 3.1> Time taken to find the correct external page for the first time (in second)

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	105	18	134	13	9	122	26	108	48	29	13
s3	157	35	47	8	16	226	109	157	7	13	36
s4	110	27	54	37	fail	47	103	fail	44	15	40
s5	10	22	36	7	48	26	26	fail	19	41	19
s9	31	135	16	19	33	38	112	fail	3	8	5
Mean time taken	82.60	47.40	57.40	16.80	26.50	91.80	75.20	132.50	24.20	21.20	22.60

<Table 3.2> Total time taken to find the answer (in second)

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	135	312	702	45	36	300	242	620	109	35	121
s3	310	253	238	27	34	523	138	332	25	19	102
s4	430	122	420	58	fail	501	243	fail	136	35	311
s5	134	121	331	115	100	40	59	fail	109	44	126
s9	49	428	656	239	201	534	219	fail	10	16	300
Mean time taken	211.60	247.20	469.40	96.80	92.75	379.60	180.20	476.00	77.80	29.80	192.00

Paths

When analyzing the links the participants have chosen till they find the answer (i.e., path taken), it is difficult to derive general currency due to the wide variety of the links people usually choose. It is often possible to analyze how many people followed the ideal thread of links and how many did not, or what links in the ideal thread people did not choose correctly. Such analysis provides the design team with a general evaluation on the effectiveness of the link categorization. However, they do not render much design ideas, other than the requirement to re-place a few links that people did not choose correctly in an ad hoc manner.

The team sought out a more systematic way to utilize the path data and found out that a rich set of design ideas could emerge by summarizing the first link the participants chose to complete each task. Table 1 summarizes the first link participants chose to complete the tasks in the IUB site test. Almost all participants chose the same link to perform tasks 2, 4, 5, and 9. To perform tasks 1, 7, 8, and 10, participants chose more than one link however there was one link that majority of the participants (i.e., three out of five) chose. For example, to perform task 7, three out of five users chose "ss" as the first link whereas two users chose different links. For tasks 3, 6, and 11, people chose three different links and there was no particular link most participants chose.

<Table 1> First link participants chose to complete each task

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	pg	aa	vc	vc	ae	cne	cne	ar	aa	lc	ss
s3	pg	aa	ss	vc	ae	cne	adm	ar	aa	lc	ss
s4	aa	aa	ss	cne	cne	pg	ss	ar	aa	lc	lc
s5	gs	aa	adm	vc	ae	ss	ss	ss	aa	pg	lc
s9	pg	ss	vc	vc	ae	pg	ss	ss	hta	ee	ch
Link variability	3	2	3	2	2	3	3	2	2	3	3

Note: Link names are abbreviated. E.g.) "pg" is "people & groups" and "ss" is "student services."

By examining the degree of variability in the choice of the first link, the team could generate design ideas. The data indicated that information related to the tasks 2, 4, 5, and 9 were categorized intuitively enough for most people to select correct entry point. On the contrary, those related to 3, 6, and 11 were not. Therefore, information related to the tasks 3, 6, and 11 needed to be either labeled better or placed in a more appropriate link hierarchy. The data also gave ideas as to where to put certain information. For example, the data clearly indicated that users expected to find information related to the task 8 either in "ar" or "ss" page. Unfortunately, the prototype did not provide that information in either of the pages.

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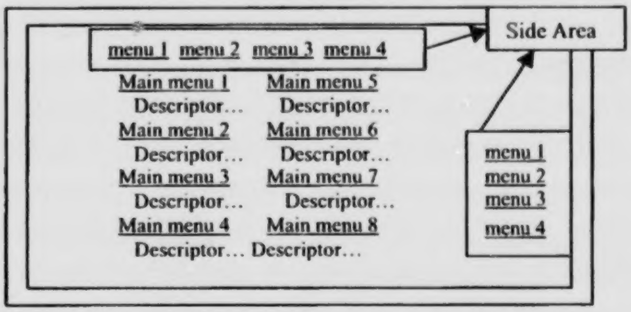
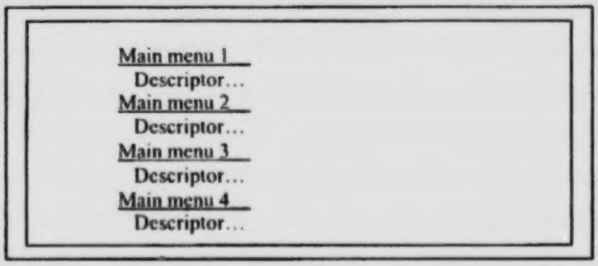
Deriving Design Ideas On Side Menus

The first level page of the IUB site contained ten main menus and each menu had three descriptors underneath. In addition to the main menus, the page included more items on the right-hand side and the upper part of the page, which the design team called "side menus." The existing web site did not have side menus. Figure 1 and 2 depict such difference in the menu structure of the first level page between the new prototype and the existing site.

<Figure 1> First level page's menu structure in the new prototype



<Figure 2> > First level page's menu structure in the existing site



The idea of having side menus in addition to main menus arose from the team's desire to maximize the use of screen space. There have been research articles reporting that some people do not scroll down while they browse menus on the page. In addition, researchers like Jakob Nielsen have been arguing for the breath of menu over the depth.

Initially, the team did not have a clear understanding about the nature of the menus appropriate to each group of the menus. Through usability tests and interviews with test participants, however, it was found out that users had a certain and unified viewpoint on the side menus. They tended to view them as a "quick" way to access "specific" and "frequently searched" information. The specific and frequently searched information are the ones highly identifiable to most users of the site. In the case of a university web site, access points to e-mail system, grading system, or commonly used knowledge base are some examples. This finding derived from the interviews and the observations of the paths test participants took while performing the tasks. Firstly, participants requested that the information presented through the side menus should be replicated somewhere in the main menus. They wanted to be sure that the information was available to them even if they would ignore the side menus entirely. This indicated that the main function of the side menus was a way to access certain information quickly rather than a primary provider of information. Secondly, the prototype subjected to the usability test had a couple of side menus whose nature was somewhat general such as "how to apply" and "computing help." To find admission and computer help information, participants used main menus rather than side menus because, they didn't know what specific information they needed to find out yet and wanted to ensure they were browsing comprehensive list of information available in the site. This indicated that the information presented through the side menus should be specific.

Having identified the nature of information appropriate for the side menus, the design team then discussed kinds of information and a naming strategy appropriate for the side menus. By examining keyword search statistics of the existing IUB site, the team found out that three most specific and frequently searched items were e-mail, INSITE, and Knowledge Base. INSITE was a student service system through which students could view or update their address, class schedules, grades, tuition and fee bills, etc. Knowledge Base was a database of university computing help. As for the menu names, the team adopted the actual names of the systems. The general public might not understand what the names meant however people belonging to the community would understand them. Since the side menus were frequently searched information, targeting people belonging to the community seemed to be appropriate.

Conclusion

Analyzing usability test data to fulfill true purpose of the usability test is not always straightforward. Design teams conduct usability tests usually to measure the degree of usability of their design (i.e., usability indices) and gather ideas for improvement (i.e., design ideas.) This paper described how IUB web team analyzed test data to meet such purposes. In conclusion, it is important to consider nature of the design when analyzing test data. In addition, the process of distilling findings from data and linking the findings to design ideas is an important part of analysis.

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A Study on Describing the Field Identity of Educational Communications in Turkey

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Abstract

Although educational communications has been accepted as an independent field of study for nearly 40 years, there is still no agreement on its conceptual definition and boundaries in Turkey.

This study was conducted by using the literature, and the experts' opinions to describe the field identity of educational communications. The researchers contributing to theoretical development of the field and practitioners developing products of educational communications in Turkey were selected to form the expert panel. Then, a three-stage Delphi technique was used to collect opinions of experts who have been geographically dispersed and hard to bring together. Data about the experts' opinions on both the different aspects of educational communications and the structure of the questionnaire were collected.

The study has shown that opinions of the researchers and practitioners on these competencies, issues, and trends are similar except the "describing and introducing the field" category, and a few of the items. In the further analysis of the data, 16 professional competencies, 10 current issues, and 19 future trends were identified.

Introduction

The term "educational communications" is used to refer a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields. In other words, educational communications is another name for the field of educational technology. Due to long history of educational television, the term "educational communications" has been used instead of educational technology for years. Thus, educational communications is used through out this paper.

Although educational communications has been accepted as an independent field of study for more than 40 years, there have always been many discussions and disagreements on its conceptual definition and boundaries (Hackbarth, 1996; Heinick, 1984). According to Seattler (1990) it looks like these conflicts will always be.

This situation causes difficulties for introducing the field to people working in other fields as well as new comers. It also grounds problems in coordination between research and practice in the field. These problems are experienced more intensely in Turkey because of diverse interpretations of the field.

However, in order to improve and extend the acceptance as a mature field of study, these sorts of problems must be overcome. By overcoming these sorts of problems in a field, theoretical supports might be provided to the practices, instructional programs and research studies might be directed, people working in the field might improve themselves, decisions that might be effective future directions of the field can be supported, and the field might be introduced to the others and new comers (Marriner, 1989).

Unfortunately there is almost no or a few study on either describing the field identity of educational communications or establishing a consensus on the definition and boundaries of the field. The first and one of the significant works was Alkan's philosophical thoughts about use of technology in education, which was completed in 1977. Since this work several significant works such as Çilenti (1983), Güler (1990), Barkan (1994) have also done. But all of them are based on translations and interpretations of foreign researchers' works and represent their personal views. So that, almost all define the field where they stand from and this situation cause conflicting problems.

In addition, multitude of variables influencing the field and mobile nature of the field make harder to come a consensus on different aspects of the field, too.

Another important reasons of having no agreement on the aspects of the field might be that there are very few people work directly educational communications. Most of these people are separated geographically and hard to bring them together.

Delphi technique is one of the useful applications for group decision-making without face-to-face interaction. The major idea beneath this technique is that "more heads are better than one". Delphi technique is described as "… an anonymous, independent, noncompetitive survey of experts to obtain consensus without necessarily involving group meetings. The technique essentially entails a series of surveys using the same experts, each survey dependent upon the responses of the previous one" (Jonassen, Hannum, & Tessmer, 1989). Although its several limitations, Delphi technique has been used for many years for especially group decision-making and future predictions.

Statement of Purpose

This study purposes to determine different aspects of educational communications such as theoretical backgrounds, research topics, emphasis areas, roles and competencies, major issues and problems, future direction; therefore, it was intended to clarify the field identity of educational communications. Specifically, the following research questions were addressed:

What kinds of phenomena have been effective on evolution of the field?
What are the emphasis areas and research topics in the field?
What are the competencies of experts of educational communications?
What are the major problems, issues and future directions in the field?

Method

Since this study requires group decision-making and future predictions, Delphi technique has been chosen for especially judgmental data collection. In addition to Delphi, theoretical works and research studies of foreign experts are also used for particularly phenomenal data collection.

Participants

This investigation was conducted with two experts groups. We hoped that our results would be of interest to academicians who either conducted research or published a distinguished work (paper, book, etc.) to contribute the body of scientific knowledge in educational communications and corporate trainers who are experts work in either a private or public sector organization and design, develop, evaluate, manage instructional activities.

It was intended to reach out the whole population since there are a few people working in the field. Fifty (5) participants involved in Phase 1, but only thirty (30) of them managed to complete Phase 3. Half of these participants were researchers (all academicians) and others were practitioners (all corporate trainers). Most of the participants who dropped the investigation were practitioners.

Instrument and Treatment

The Delphi instrument unfolded in three phases. Phase 1 consisted of an introductory letter and a request for participants to assist in offering the aspects of the field worth for investigating. In addition to these instruments conversations were conducted mostly through telephone calls. Submitted statements were compiled, analyzed to identify the aspects of educational communications for investigating. As a result of this phase 10 aspects were identified among the offered ones: History, definition, theoretical foundations, research topics, emphasis areas, experts' roles and competencies, instructional programs, major issues and problems, future trends and directions, process of educational communications.

After having conducted a literature review, we determined 143 statements and developed a Likert type questionnaire including these statements for Phase 2. In Phase 2 of the study, this questionnaire was sent to each respondent of Phase 1, it was asked each person to rate each of the 143 statements as to how strongly they anticipated the statement. In the Likert type questionnaire the Endpoint 1 was to indicate that the participants strongly disagree the statement, and Endpoint 5 to indicate that the participants strongly agree the statement. Also it was provided to indicate their thoughts on the overall structure of the questionnaire.

After reaching expected return rate (17 for each group), we analyzed the data and concluded that most of these statements were phenomenal data and required no further investigation. In other words, the participants indicated that these must be accepted as they are so that they must not be included into the questionnaire. These statements were excluded from the questionnaire owing to the consistency with the literature. As a result this Phase, 143 discrete statements was reduced to 70 and these were categorized into three groups: competencies, problems, and trends.

In Phase 3, the last version of the questionnaire sent to the determined participants of Phase 1. Unfortunately the ones did not respond the Phase 1 and Phase 2 repeated their attitudes about responding even though we reach most of them through phone and requested to respond. After receiving 15 responds for each group, the data analyzed.

Through this three-phased Delphi study both a new standard questionnaire developed and experts' viewpoints were integrated.

Results

In Phase 3, we calculated the mean score on all items to be 3,87, with a standard deviation of .43. These and frequency of scores, in general terms, indicate that the average score on the 70 items leaned toward an agreement –but not a strong one- side of the scale. Also it can be observed that there is not a big variation among all participants' responses. When the two groups of researchers and practitioners were compared, it was found that the researchers were not only more agreed on the statements than practitioners (mean scores of 4.0 versus 3.73) but they also show a few variations in their responses as shown by the decrease in standard deviation (.028 versus 0.52) (Table 1).

Table 1: Means and Standard Deviation of Groups

Groups	Item Mean Score	Standard Deviation
Researchers	4.00	0.28
Practitioners	3.73	0.52
Total	3.87	0.43

The analysis of the results revealed that participants rated 38 of 70 items with mean scores higher than 3.87. This finding might be interpreted as that there is a strong agreement on these statements related to the field.

It was also compared the items rated by the researchers with those rated by the practitioners. An analysis by t test of non-independent items yielded a statistically significant difference on 11 of the 70 items between the two groups at or below an alpha level of .05. Except one of the item, related to the trend about decrease in research studies, in all other cases, researchers rated the items to be more agreed than practitioners.

Discussions

The results reached in this investigation are given below into four groups according to the research questions.

Phenomena Influence the Evolution of the Field

This part heavily depends on phenomenal data collected from literature. The literature review shown that the term "educational communications" refer to a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields. The roots of the field can be traced back to the works of Comenius. Educational communications was considered as a movement until the mid 1960s and then it has accepted as a field of scientific study. During the period of being considered as a movement, it was focused on the effective presentations of the content with an instructor and the audio-visual aids. During 1950s, with the influences of communication, system and particularly learning theories, the focus shifted on development of instructional materials and transferring learning theories into instructional activities. The previous focus rooted the educational media emphasis area and latter leaded the development of instructional design models and theories (Ely, 1996).

Most of the current practices and research studies are related to the instructional design. The results of Delphi show that the highest means scores observed on statements related to instructional design. In this context, it might be claimed that the investigation supports the idea that instructional design has a significant role in educational communications.

On the other hand, literature reveals that with the influence of constructivist approach, most of the educational communication efforts changed toward design or organization of learning environments where learners learn through interacting with authentic contexts (Winn & Snyder, 1996). During the Delphi investigations all participants agreed on the items related to this issue; therefore, this can be considered as an indicator of support of this study to the literature.

Emphasis Areas and Research

This part also depends on phenomenal data collected from literature. Research studies show us the topics that educational communication specialists are dealing with (Thompson, Simonson & Hargrave, 1996). Some of the variables are motivation, transfer, learning context, feedback, learning strategies, learning styles, attention focusing, confidence, time-on-task, retention. Experts use these sorts of variables to design effective, efficient, and appealing learning environments. This also supports the definition of educational communications, which refer to a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields.

On the other hand, there are so many emphasis areas in the field. But, this might display the field too broad and unorganized, and might make harder to clarify the theoretical boundaries of the field. In order to eliminate these dangers, provide leadership for the studies, and make the introduction of the field easier, there might be a need for categorizing the emphasis areas.

Thus, we categorized all areas into three major emphasis areas after having examined the research studies, practices, developments and trends of the field. These are (a) instructional design, (b) educational media, and (c) human resources development. The items included in the questionnaire are falling into one of these areas. This situation supports this categorization of emphasis areas.

Competencies

There are several sources about the competencies of educational communication specialists in the literature. By using these sources and views of experts 31 competencies were determined. However after having a detailed investigation, we have decided to combine related ones so that we could manage to lessen the number of competencies. As a result of these efforts, 16 major competencies for educational communication specialist were concluded on. These competencies have shown similarity with the competencies determined for instructional designer by AECT and NSPI Task Force. These are:

- Analyze the needs
- Determine the projects appropriate for instructional design
- Describe the learner characteristics
- Analyze the characteristics of organizational environment
- Conduct task/content/job analysis
- Write performance objectives
- Develop achievement tests
- Sequence the objectives
- Select the instructional strategy
- Design the educational media
- Evaluate the outputs of education, instruction and training

- Design the management systems of learning
- Communicate verbally, visually and aurally
- Consult for the individual and career development
- Plan and monitor his/her own development
- Introduce educational communication field to the other and extend its applications

On the other hand, although instructional design is a well known and highly accepted emphasis area of educational communications all over the World, there are very few people have shown interest and worked in the this field in Turkey. Having no Turkish books on instructional design can also show how Turkish scholars pay attention to this area. However the Higher Education Council required an instructional design course for all the Computer Teaching and Instructional Technology undergraduate programs of education colleges but contents of most of these courses are far from instructional design and usually more related to the theories of teaching and learning. Only in Educational Communications and Planning Department of Anadolu University, several courses in varying levels (graduate, undergraduate) related to the instructional design such as "Introduction to Instructional Design, Instructional Design Models and Theories, Needs Assessment, Instructional Media Design have been offered since 1994. It is our hope that there will be more promising efforts to show the power and the importance of instructional design.

Major Problems and Future Directions

Based on the data collected form participants and the literature, 16 major problems identified and included the last version of the questionnaire. However, the results exposed that there is an agreement on only 6 of 16 items.

Among these 6 problems, the one related to the separation of evaluation as an individual field apart from the educational communications is interesting. It can be noticed in the literature that evaluation has been taken as a separate field of study for years but there is a tendency that claims that evaluation is one of the main parts of instructional design and cannot be regarded separate from this process. Results of the questionnaire demonstrate that there is a significant difference on this item between the groups. Researchers strongly believe in such a problem while practitioners are not sure about the existence of this problem. We interpret this as practitioners show more enthusiasm and pay more attention on evaluation today than they did in the past.

The item related to the research in the field is also interesting one. This item includes the idea that the attention in the field focuses much more on practice than research. Literature reveals the existence of such a problem (Gentry & Csete, 1991). However, the results of the questionnaire indicate that this is not a true statement anymore (mean score of 2.77). In other words the participants do not agree with this statement. Though there is a strong disagreement on this item between the groups. For only this item researchers did not supported the statement more strongly than practitioners (means scores of 2.40 versus 3.13). We interpreted this as an increase in research studies conducted during the recent years and because of this researchers believe that they do conduct more research now compare to they did in the past. In addition, parishioners are not able to follow these studies as good as researchers.

Another problem uncovered through this investigation is that an uncertainty about the theoretical boundaries of the field is still continuing. The main reason of this problem is the lack of enough research or other studies on this topic. Also having no professional organization and publication about the field of educational communications in Turkey supports this problem. The field usually is perceived as a field of study deals with bringing new technological tools into education. Because of this narrow view investments generally go to the production of new tools. The wide spread structure of the descriptive studies related to the field also supports the problem. This problem causes the diverse structure of instructional programs, misconceptions about the field and its place in the society, lack of relationship with other fields.

We concluded that the main reason under beneath most of these problems is lack of clarification of scope of the field. This main problem creates more problems. Also literature is full of same ideas on this problem (e.g. Gentry & Csete, 1991; Ely, 1995).

On the other hand, the last version of the questionnaire included 23 statements related to the future trends. Among all these statements, only for the one related to the being a leader in the educational changes is there a significant difference between the groups. Results indicate that practitioners are more suspicious than researcher about future the roles of the field in educational settings. The economic problems of the Country make graduates of the educational communication programs hard to find decent jobs. This situation might affect the responds of the participants, especially practitioners.

Participants also indicate that graduates of the programs will, sama as today, have almost no chance to be employed in public organizations such as ministry of education, etc. The economy experts are expressing the misuse of human resources in the governmental and public organizations, and harmfulness of this situation on economy. We think that if the graduates of educational communications could find opportunities to work in these organizations, there might be a slight chance to solve this misusage. One of the emphasis areas of the field is human resources development and the graduates have skills and attitudes toward correct usage of human resources.

Another interesting finding is that participants do not agree on the increase in distance education. This result conflicts with the literature. We interpret this as that although Turkey has a long history, this technology (distance education) is not accepted and it is not extended, as it has to be.

The results about the use of textbooks in the future is also interesting and conflicting with the literature. The participants agree on that the textbooks will still be used widely in almost all instructional settings although literature indicates a gradual decrease in use of textbooks. We think that use of very old-fashioned instructional approaches in almost every grade of public education and misleading applications of technology integration strengthen the idea that textbooks are the unique and most reliable sources of knowledge and increased the fear of technology usage.

On the other hand, results related to the statements about different aspects of instructional design such as increase in applications of constructivist approach, providing more learner control, wide spread use of team learning show consistency with the literature. However, applications prove that although experts believe in the importance of these applications, they find difficult to apply them in their instructions in Turkey.

Same as instructional design items, participants agree on the statements related to educational media such as development of virtual learning environments, use of digital technologies, wide speared use of computer networks. There is an increase in intensity of using web and other computer related opportunities for instructional purposes. When these practices are observed, it can be identified that most of these efforts have no pedagogical background and because of this they fail to help people learn. However, there is a tendency to include more and modern pedagogical aspects into instructional practices in Turkey.

Conclusions and Further Investigations

We strongly believe that the most important result of this study is that it is hard to draw strict boundaries of the field of educational communications due to its peripatetic nature and continues influences of the other fields. However, we propose that these sorts of decision-making and/or future prediction studies should be conducted regularly to keep up the developments in the field because fuzzy or conflicting ideas about the varying aspects of educational communications might create serious problems. Updated studies, for sure, will not only provide help for practitioners and researchers but also make leadership easier.

Turkey definitely needs more of these sorts of studies to be able to establish a consensus on different aspects of the field including names, programs, definitions, trends, applications, issues, etc. The first step might be a professional organization that will have the mission of providing leadership in the field in Turkey. So that publications and meetings can be supported easily to provide good communication channels among the people in the field, standard programs can be offered to bring up new people into the field, and demonstrate effective, efficient, appealing examples of educational communication practices.

In order to increase the validity and reliability of these sorts of research findings, researchers should include as many experts dealing with different aspects of the field such as employers of educational communication graduates and foreign experts as possible. So that new ideas might come up and stronger agreements might be achieved. However, Delphi technique is a time consuming activity. Most of the time usually spends for mailing and analyzing the responses but new technological tools provide researchers numerous advantages. E-mail is one of these advantages. E-mail based a Delphi study will of course save time. Also using some content analysis tools with e-mail might provide researchers flexibility of using different type of questionnaires such as the ones includes open-ended items.

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The Effects of MIMICing Instructional Theory with MIMIC (Multiple Intelligent Mentors Instructing Collaboratively), an Agent-Based Learning Environment

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Abstract

In this exploratory experimental study, 135 pre-service teachers developed an instructional plan for a case study within the MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) computer-based environment. Three-dimensional, animated pedagogical computer agents, representing constructivist and instructivist approaches to instructional planning, served as instructional mentors within the environment and were available to provide suggestions. The research design was comprised of two two-factor MANOVAs with the instructivist agent (present, absent) and constructivist agent (present, absent) serving as the two factors, with two groups of dependent measures --awareness and attitude. Additionally, the value of the agents and overall differences between high and low performers were investigated. Regarding awareness, main effects for the presence of the constructivist agent indicated that when the constructivist agent was present participants tended to report a change in their perspective of instructional planning, reflected less on their thinking, and developed instructional plans rated as more constructivist in underlying pedagogy. Regarding attitude, a main effect for the presence of the instructivist agent indicated that when the instructivist agent was present, participants reported a more negative disposition regarding instructional planning. Results are discussed in terms of the impact on teaching instructional planning to pre-service teachers.

Introduction

In the field of instructional design, there are diverse theories and approaches to instruction (e.g., (Driscoll, 2000)). For pre-service teachers, the importance of seeing how these theories relate to real instructional problems is critical. Two prominent yet differing approaches to instructional planning are systematic instructional planning (referred to here as instructivism), based on an objectivist epistemology, and constructivism, based on an interpretivist epistemology (Jonassen, 1991). These two philosophical approaches lead to different understandings of human cognition and affect both the instruction that is developed and what evaluations are feasible and appropriate (Roblyer, 1996; Yarusso, 1992).

With its objectivist epistemic roots regarding knowledge, the underlying assumption of traditional instructional planning is that knowledge can and should be transmitted from teacher to student. An instructivist approach to instructional planning emphasizes knowledge transfer and teacher-centered learning environments, where skills are taught sequentially, incorporating individualized work with traditional assessment methods (Roblyer, Edwards, & Havriluk, 1997). This type of systematic approach to instruction has been shown to be effective due to its focus on clearly identifying goals and systematically developing instructional activities and assessment that lead to the attainment of the goals (Reiser & Dick, 1996).

In contrast, constructivism has its epistemic roots in interpretivism, which maintains that knowledge is personally constructed within individuals and does not exist external to the individual. The constructivist approach tends to focus on more student-centered environments, to provide activities that facilitate knowledge construction and generative learning (e.g., Wittrock, 1990). Driscoll (2000) describes five attributes of constructivist instruction: 1) embedding learning in complex and realistic environments; 2) providing for social negotiation; 3) supporting multiple perspectives and use of multiple modes of representation; 4) encouraging ownership in learning; and, 5) nurturing self-awareness of the knowledge construction process (pp. 382-383). To implement these features as part of the constructivist planning process, pre-service teachers must learn to emphasize the process of learning more than the end product. Constructivist approaches have been found to be particularly beneficial for developing meaningful learning activities and engaging students in higher order thinking (Jonassen, Peck, & Wilson, 1999)

One way to authentically demonstrate these two distinct approaches to pre-service teachers would be through seasoned professionals modeling the approaches in the context of a real instructional situation. Exposure and interaction with several experts describing instructional content matter from different points of view can be very rewarding for the learner (Laurel, Oren, & Don, 1990) and can help the learner to establish the best personalized approach to understanding the content. Further, such exposure to multiple pedagogical perspectives could enhance pre-service teachers' cognitive flexibility by requiring them to independently consider alternative points-of-view. Viewing an instructional problem from multiple perspectives is also desirable for promoting reflective thinking and problem solving, qualities important for pre-service teachers who are learning to be teaching professionals. Further, as Jonassen (1997) describes, "instructional planning is an archetypal ill-structured problem because "the designer is constrained by circumstances, though in most design problems, there are a variety of solutions, each one of which may work as well as any other (p. 69)." Given that more than one problem-solving path is possible to reach a solution, the ability for a pre-service teacher to take multiple perspectives on instructional planning is appropriate and necessary. Overall while it may be beneficial for our pre-service teachers to see their role in the classroom from multiple pedagogical perspectives (Bennett & Spalding, 1992), devising this sort of experiential exposure is difficult to implement with human instructors.

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A promising possibility for demonstrating and experiencing different instructional approaches is through computer-based agents serving as a pedagogical mentors (Baylor, in press). A software agent is an independent computer program operating within software environments such as operating systems, databases, or computer networks (Roesler and Hawkins, 1994). Agents appear to have the characteristics of an animate being, and simulate a human relationship by doing something that another person could otherwise do for you (Seiker, 1994). Animated pedagogical agents have lifelike qualities, and can employ verbal instructional explanations together with nonverbal forms of communication (e.g., gaze, gesture, conveying emotion) in interacting with the learner. Along this line, Lester and colleagues (Johnson, Rickel, & Lester, 2000; Lester, Stone, & Stelling, 1999) have suggested that life-like agent characters are ideal to serve as tutors, coaches or guides in knowledge-based learning environments.

Further, learners treat computer-based agents as human, even when the computer interface is not explicitly anthropomorphic (Reeves & Nass, 1996).

Building upon Laurel's (1990; 1997) suggestion for agents to represent different "roles" such as characters in a play, the next question to consider is whether agents could represent different instructional roles as pedagogical mentors. While the idea of representing multiple instructional roles through computer-based media has been implemented in other research, there have been limited controlled studies. The ETOILE system for teaching educational psychology principles (Dillenbourg, Mendelsohn, & Schneider, 1994) incorporated five agents, each labeled after the teaching styles they implement: Skinner, Bloom, Vygotsky, Piaget, and Papert. Each agent was implemented as an independent rule base that was separated out from the content rather than being domain-specific. The five teaching agents implement decreasing level of directiveness: Skinner works step by stop, Bloom makes larger steps but with close control of mastery, Vygotsky is based on participation, Piaget intervenes only to point out problems and Papert does not interrupt the learner. The ETOILE system also includes a "coach" agent that is in charge of which tutor is used although the learner may also select or remove a tutor. The ETOILE system was not designed for the purpose of instructional research, but rather to conceptualize the underlying engineering principles for the multiple agents; consequently, there is no empirical evidence regarding its instructional impact.

MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) is an agent-based learning environment developed for the purpose of instructional research (Baylor, 1999, 2000b). MIMIC situates instructional planning within a specific context: a case study of a thirteen-year old girl struggling with the economics concepts of supply and demand. In MIMIC, agents explicitly represent different perspectives of instructional planning (objectivism and constructivism) and facilitate pre-service teachers' internalization of these approaches. The animated three-dimensional pedagogical agents serve as scaffolds, providing cognitive support to pre-service teachers while they write an instructional plan. The learner has control over the amount of assistance and when it will be provided by the agent(s). In related research, participants working with both the instructivist and constructivist pedagogical agents could differentiate between them and could explicate the two theories that they represented (Baylor, in press). The agents were also reported to be believable and useful. (Baylor, in press).

Hietala & Niemirepo (1998) suggest that the same social factors that occur in learning communities with human beings are also influential in a learning community consisting of multiple artificial teaching and learning agents. They refer to this aspect as the need for pedagogical multiplicity of teachers, suggesting that the many levels and complexities of the learning process might be alleviated by providing more alternatives to the learner via an "extended family of intelligent agents." Essentially, an agent-based learning environment such as MIMIC allows pre-service teachers to figuratively "put on different hats" and facilitates them in switching roles when needed to solve an instructional problem. Through experiential interaction with the agents, the pre-service teacher is facilitated in a deep approach to the task, focusing on the meaning of the instructional planning process itself, rather than a surface approach which would involve simply writing an instructional plan following a "recipe." In this way, the pre-service teachers' experience of instructional planning and the specific meaning it has for them could be considered as the most fundamental aspect of learning (Marton & Booth, 1997).

In this exploratory experimental study, it is hypothesized that the presence of the instructivist and constructivist agent(s) (especially both simultaneously) will impact learners' awareness of instructional planning by increasing their reflection during the instructional planning process and changing their perspective regarding instructional planning. It is not hypothesized that the presence of agents will affect performance given that it is generally found that the presence of agents does not significantly improve performance (Dehn & van Mulken, 2000); however, it is predicted that pre-service teachers' transformation of awareness will be reflected by the instructivist or constructivist "flavor" of their instructional plans, depending on which agent(s) are present. In terms of attitudes, it is predicted that the presence of the agents as scaffolds would positively influence participants' dispositions, self-efficacy and perceived instrumentality regarding instructional planning.

Methods

Sample

The sample consisted of 135 pre-service teachers, in eight sections of an "Introduction to Educational Technology" course. As part of this required course, the participants had already been taught an instructivist model of instructional planning (Reiser & Dick, 1996) and a constructivist approach to instructional planning (Grabe & Grabe, 2001) with identical course material (e.g., lectures, Powerpoint slides, assignments, exams) across the eight sections. Participation in this study was a required activity for class participants, and they received course credit for participating. The mean age of the sample was 19.76 years (*SD*=2.13). Of those reporting ethnicity, 84% were Caucasian, 4% were Hispanic, 10% were African American, and 2% were of other groups. Of those reporting gender, 21.5% of the sample were male and 78.5% were female. Sixty percent (the majority) of the participants were sophomores, 27% were juniors with 7% freshman and 6% seniors. In terms of prior experience with instructional planning, participants' mean score was 2.23, (*SD*=.97), where 1=no experience and 5=very much experience, indicating that overall they had little prior experience. There were no significant differences in age and GPA among the participants in all conditions. In terms of ethnicity, gender, and year in school, chi-square analyses revealed no significant differences between the groups.

Multiple Intelligent Mentors Instructing Collaboratively (MIMIC) Environment

From the learner's perspective, MIMIC consists of an introduction, a case study, blueprints stage, plan stage, and assessment stage. The introduction begins with the statement that "We are pleased that you have decided to join our educational consulting firm, 'Instruction Inc.' Given your new skills in instructional planning, we have a project for which we really need your help," and briefly describes the case study situation with thirteen-year-old Anna and her teacher Mr. Lange. Following this, the participant is instructed how to move throughout the environment:

Through our computer-based system, you will be able to follow 3 steps in devising your instructional solution. The three components of the project include the following:

1. STEP 1: Blueprints for Instruction: This is where you will first determine the goals of the instruction; in other words WHAT you want the learner to be able to do at the end of the process.
2. STEP 2: Developing the Instructional Plan: Here you will get into the "heart" of the planning process, and develop a detailed plan that a teacher can use to carry out the instruction as you specify.
3. STEP 3: Assessment: At this stage you will determine how to measure whether the learner actually learned what you intended.

At any time you may refer back to the details of the case study to refresh your memory of the situation.
You may go back and forth as much as you would like among the 3 components. And when you are completely finished with your plan, press the Finished button you'll find in the assessment stage.

Next, if participant is in a 1- or 2-agent condition, the personal Advisor(s) (see "Pedagogical Agents" section) would introduce themselves and their role.

The environment organized the participant's instructional planning processes into four main phases which will be described below, each indicated through large icon-buttons: case study, blueprints, planning, and assessment. At any time it is possible for the participant to move from one phase to the other although it is not possible for the participant to return to the introductory screens. Once the participant enters the assessment stage, an additional button labeled "Finished" is provided. After selecting "Finished" the participant is asked "Are you ready to exit the application and go to the exit survey?" Upon selecting "OK" the participant answers post-questions.

Case study. The case study was developed for MIMIC given that it is difficult to find existing case studies that are appropriate (Ertmer & Russell, 1995). It consisted of a description of Anna and her problems learning supply and demand, her teacher Mr. Lange, and her school in Texas. The concept of supply and demand was chosen as it is relatively domain-independent of specialty areas for instruction and requires less specific prior knowledge. Links were provided so that the participant could access Anna's homework that contained comments from Mr. Lange, and his personal planning notes which included text and graphics. In this way, participants could review the necessary content for themselves as well as evaluate Anna's situation.

Blueprints. The purpose of this phase was listed on-screen as follows: "The purpose of this step is for you to decide what you want Anna to learn. What have you determined to be the learning goals? List them clearly in the workspace below. For reference you may want to see the stated Texas standards and benchmarks regarding supply/demand for eighth graders, with links below." A text-box field was provided within which the participant could list the instructional goals or objectives. Two links provided additional information regarding Texas standards and benchmarks for supply/demand.

Planning. The purpose of this phase was listed on-screen as "To develop a detailed instructional plan for Anna. " A text-box field was provided within which the participant could enter the instructional plan.

Assessment. The purpose of this phase was listed on-screen as follows: "The purpose of this phase is to develop ways to determine if Anna learned what you initially defined in the blueprints phase. Please describe this assessment in detail in the space below. " A text-box field was provided within which the participant could list the assessment.

Pedagogical Agents

Depending on the experimental condition, one or two Microsoft Agent characters (Peedy the Parrot and Merlin the Wizard) were implemented as "Advisors" to the participants. Characters were randomly assigned to represent the instructivist and constructivist agents and to control for possible differences. The Advisors were referred to by gender-neutral names – Jan and Chris. Jan was always the instructivist advisor, representing traditional systematic instructional planning including the problem-solving aspects of Instructional Systems Design (ISD) as characterized by Dick & Carey (1996) and Reiser & Dick (1996). Chris was always the constructivist advisor, representing a learner-centered approach, focusing on the importance of the context of learning, stressing that learning involves active interaction, and emphasizing the process rather than the product of learning (Driscoll, 2000).

The purpose of the agents was to serve as mentors (Baylor, 2000a) and to operationalize the instructivist and constructivist approaches to instructional planning. When one or two agents were present the following events resulted: 1) the agent(s) provide(s) an initial observation upon entering each of the four MIMIC planning stages; 2) the agent(s) provide(s) reflection questions to encourage self-evaluation consisting of statements "Make sure you are not just talking about how you would do it; actually create the instruction for Mr. Lange (Anna's teacher).", "Actually develop the content-related activities", or "Apply the plan specifically to the topic of supply and demand" every five minutes upon entering a stage; 3) the agent(s) would provide an example of their instructional plans following the participant's development of an instructional plan; and, 4) the agent(s) would provide additional suggestions when selected by the participant. Agent suggestions were specific to the case study and were developed and validated by experts in instructional planning together with the consultation of an economics professor. The available suggestions (specific to each planning phase) would appear in a pop-up box for the participant to select. For example, in the plan phase, one available suggestion is "What is my role in the learning process?" If this suggestion were selected from the instructivist agent, the agent would reply "You need to be in charge of the learning process for Anna. You need to organize the materials for Anna, to create an optimal learning environment." The same suggestion if requested from the constructivist agent would be "Anna should be at the center of the learning process. This will encourage Anna's initiative, get Anna to think and to reflect, and make the information real for Anna." The blueprints phase had two suggestions, the plan phase had five suggestions, and the assessment phase had one suggestion. See a related study (Baylor, in press) for a complete listing and description of all agent suggestions.

Measures

Awareness. Awareness was assessed through three dependent measures: whether the participant changed perspective in instructional design, amount of participant's reflective thinking, and the underlying pedagogy of the participant-designed instructional plan. To assess whether use of the system *changed participants' perspective of instructional design*, they were first asked "Did using this program change your perspective of instructional design? (yes/no)" which was coded as a 1 (yes) or 0 (no). To assess participants' *self-reported reflections*, they were asked, "How often did you reflect on your thinking during the process?" on a Likert scale of 1-3 with "Not at all," "Several times," and "Frequently" as the three levels. To assess the *underlying pedagogy of the instructional plans*, the instructional plans were scored according to their overall pedagogical "flavor," on a scale from 1 to 10. Given that certain instructional plan features are representative of both instructivist and constructivist pedagogies (e.g., the importance of considering prior knowledge), the focus was on assessing the presence (or absence) of constructivist characteristics, as they were more salient and differentiable. A high score in this measure indicates that there were more constructivist aspects to the plan such as a student-centered approach, students' involvement with constructing knowledge, a focus on students' reasoning/critical thinking, and/or situated learning. A low score in this measure indicates that there are less constructivist and more characteristically instructivist elements within the plan. Two of the researchers met and together discussed what characterized a score of 1-10 for the presence of underlying pedagogy (where 1=not at all constructivist and 10=highly constructivist) for five sample instructional plans. Following that, each researcher independently scored 15 instructional plans. Inter-rater reliability between the two researchers was determined to be greater than .9 for the fifteen instructional plans. One of the researchers then scored the remainder of the instructional plans using the same rubric. Both researchers were blind as to the conditions of the participants throughout the rating process.

Attitudes. Attitudes were assessed by three dependent measures, each as repeated-measures: self-efficacy, disposition, and perceived instrumentality. To assess participants' *self-efficacy*, one item to measure the students' self-efficacy beliefs about instructional planning was administered before entering and after exiting the MIMIC environment. It was developed based on Bandura and Schunk's (1981) guidelines. All participants were asked "How sure are you that you can write a lesson plan?" on a scale from 1 being not-sure to 9 being very sure. The test-retest reliability was $r=.62$ ($p<.001$). To assess participants' *disposition* toward instructional planning, each participant was asked to write two adjectives to "Describe what you think about instructional planning." This method was employed to obtain the participants' personal affect regarding instructional planning as opposed to the response set that could bias them to choose more favorable adjectives if adjectives were presented in a list. The adjectives were coded according to three levels: as -1 if both were negative, as 0 if one was negative and the other positive, and as +1 if both were positive. The items were coded by two raters independently. Interrater reliability was established at .95. There were only two disagreements about two sets of adjectives which were resolved through discussion. Two adjective pairs were discarded because they could not be classified. The validity of this measure was established in (Kitsantas & Baylor, 2001) through concurrent validity of initial disposition with initial self-efficacy scores, given that research has shown that self-efficacious students generally have positive affect (Bandura, 1986). The test-retest reliability was $r=.55$, $p<.001$. To assess the participants' *perceived instrumentality*, or perceived importance of instructional planning, the participants were asked to rate "How important is writing a lesson plan to you as a future professional?" on a scale of 1 to 5 where 1= not important, 2=fairly important, 3=important, 4=very important, and 5=extremely important. Test-retest reliability was $r=.83$, $p<.001$.

Performance. Within MIMIC, all participants developed an instructional plan to teach the concepts of supply and demand to Anna. Each instructional plan was scored according to a rubric that consisted of four sub-areas. The four sub-areas of the rubric were goals/objectives, procedure, assessment, and holistic, the first three being aligned with the major components of instructional planning (goals/objectives, procedure, and assessment). For the goals/objectives sub-score, the plans were rated according to how clearly the goals/objectives were stated and how specifically the purpose of instruction was described. For the procedure sub-score, the plans were rated according to the meaningfulness and effectiveness of the instructional activities, whether they were in a logical sequence, and whether they addressed the goals stated in the blueprints phase. For the assessment sub-score, the plans were rated according to whether the assessment matched the goals/objectives, and whether it was logical. For the holistic sub-score, the plans were rated according to whether the plan was overall reasonable and effective. The overall performance score was the compilation of these four sub-scores (each rated from 1 to 5), with a potential range of 4-20. Two of the researchers met and together discussed what characterized a score of 1 through 5 (where 1=poor and 5=excellent) for each of the four sub-areas for five sample instructional plans. Following that, each researcher independently scored 15 instructional plans. Inter-rater reliability between the two researchers was determined to be greater than .9 for the fifteen instructional plans. One of the researchers then scored the remainder of the instructional plans using the same rubric. Both researchers were blind as to the conditions of the participants throughout the rating process.

Agent value. Participants in conditions where agents were present were asked to rate the value of the agents in several areas. Specifically, they were asked via Likert-scale formatted questions, "Did you enjoy working with <agent>?" (Not at all / A little / Very much/ Extremely); "Did you pay attention when <agent> made suggestions?" (Not at all / Not usually / Usually / Always); "Overall, was <agent> annoying or useful?" (Extremely annoying / annoying / useful / very useful); and, "Did you generally agree with <agent>'s suggestions? (yes/no)"

Procedure

All participants logged in to the MIMIC computer environment and answered computer-based questions regarding gender, age, and class section number. Next, the participants' perceived instrumentality, disposition regarding instructional planning, prior experience with instructional planning, and self-efficacy beliefs toward instructional planning were assessed. Following these initial measures, the participant entered the introduction to the MIMIC environment (see the MIMIC section). Following this introduction, and immediately before entering the environment, participants' self-efficacy regarding the project was ascertained. Next, the participants worked through the case study, blueprints stage, planning stage, and assessment stage, developing an instructional plan. Depending on the condition (see "Pedagogical Agents" section), 0-2 agents were present within the environment, serving to represent instructional planning approaches (objectivism and/or constructivism). All participants worked independently within the environment at their own pace. Following completion of the instructional plan within the environment, all participants answered computer-based questions regarding amount of self-reflection, value of agent(s), perspective of instructional planning, perceived instrumentality, disposition, and self-efficacy. The entire procedure took approximately 90 minutes.

Design and Data Analysis

A three-factor MANOVA (instructivist agent: present, absent; constructivist agent: present, absent; agent character: Peedy, Merlin) was the initial method used for data analysis where agent character (Peedy the Parrot or Merlin the Wizard) was assigned as a within-subjects factor to test for possible differences in agent character. After it was determined that agent character did not play a factor, that factor was removed from further analysis leaving a two-factor MANOVA as the main method for data analysis. The data was analyzed according to two groups of dependent measures: awareness (comprised of change in perspective, reflection, and underlying pedagogy of instructional plan), and attitude (comprised of self-efficacy, disposition, and perceived instrumentality), each of which was assessed via a two-factor MANOVA. The analysis of attitude (comprised of self-efficacy, disposition, and perceived instrumentality) was treated as a repeated measures MANOVA. For some analyses that focused on agent combinations, a one-way MANOVA/ANOVA was also performed with condition (no agents, instructivist only, constructivist only, both agents) as the factor. To analyze participants' value of the agents, independent-group t-tests were used for the questions comparing one agent on a particular attribute, and paired-group t-tests or chi-square analysis were used for the questions regarding participants who received both agents.

Results

General

There were no statistically significant differences among agent conditions regarding the average number of suggestions requested from the agents. The average number of suggestions selected was M=10.34.

Awareness

The three dependent measures for awareness include whether the participant changed in perspective regarding instructional planning, amount of self-reflection, and underlying pedagogy of participant-designed instructional plan and were assessed through a two-way MANOVA with instructivist (present, absent) and constructivist (present, absent) as the between-subject factors.

Perspective of instructional planning. Results from the two-way MANOVA revealed a main effect for the constructivist agent on change in perspective in instructional planning, $F(1, 131) = 9.82$, $p<.01$, where $M=.71$ (present) versus $M=.45$ (absent), indicating that when the constructivist agent was present, participants were more likely to report that MIMIC changed their perspective of instructional planning. There were no other significant main effects or interactions. To determine the relative differences of change in perspective among the four agent conditions, a one-way ANOVA with condition (no agents, instructivist only, constructivist only, both agents) as the factor was conducted and revealed a significant main effect for agent condition, $F(3, 131)=3.74$, $p=.01$. Post-hoc Tukey's tests indicated that the constructivist-only condition elicited the most change in perspective ($M=.80$) and was significantly greater than both the instructivist-only condition ($M=.47$) and the no-agent conditions ($M=.44$), but was not significantly greater than the both-agents condition, which ranked second in overall change in perspective ($M=.63$).

Self-reported reflection. The two-factor MANOVA revealed a main effect for the constructivist agent, indicating that when the constructivist agent was present, participants reported reflecting less ($M=2.24$), than when it was absent ($M=2.43$), $F(1, 131)=4.73$, $p<.05$. There were no significant differences between high and low performers on self-reported reflection.

Underlying pedagogy of instructional plan. The two-factor MANOVA indicated a main effect for the constructivist agent, $F(1,131)=11.28$, $p=.001$, where the presence of the constructivist agent was related to participants developing more constructivist-oriented instructional plans ($M=6.12$) than when it was absent ($M=4.47$). While there was not a statistically significant main effect for the instructivist agent, there were numerical differences showing that its presence was associated with lower scores ($M=4.92$) than its absence ($M=5.72$), indicating its positive relation to an instructivist underlying pedagogy. An independent t-test also showed that high achievers developed plans that were significantly more constructivist ($M=6.08$) in approach than low achievers ($M=4.29$). The overall mean for the underlying level of pedagogy for all participants was $M=5.35$, $SD=3.01$.

Attitude Attitude was analyzed through a repeated-measures two-factor MANOVA, with disposition, self-efficacy, and perceived instrumentality as the dependent measures, each assessed both before and after working in MIMIC, and with the instructivist agent and the constructivist agent as the two between-subject factors.

Disposition regarding instructional planning The two-factor repeated-measures MANOVA indicated a main effect for the presence of instructivist agent $F(1, 128)=3.46$, $p<.05$, revealing that when the instructivist agent was present, participants had significantly lower dispositions regarding instructional planning ($M=.54$) than when the instructivist agent was absent ($M=.75$). Overall, participants' disposition toward instructional planning was generally positive (where –1 represents negative, 0 represents neutral, and 1 represents positive), both before ($M=.63$) and after ($M=.58$) working within MIMIC.

Self-efficacy. The two-factor repeated-measures MANOVA revealed a main effect for time of assessment, showing that participants overall increased in self-efficacy ($M=5.46$ vs. $M=6.01$) as a result of MIMIC, $F(1,128)=12.54$, $p=.001$. There were no significant main effects or interactions for the presence or absence of the constructivist and instructivist agents. As would be expected, self-efficacy was highly related to participants' prior experience with instructional planning. Those participants with high experience writing lesson plans (3, 4, 5) as compared to those with low experience (1, 2; where 1=no experience and 5=very much experience), had significantly higher self-efficacy both before ($M=6.40$ vs. $M=4.91$), $t(133) = 4.06$, $p<.001$, and after ($M=6.62$ vs $M=5.63$), $t(133)=3.11$, $p=.001$, using MIMIC.

Perceived instrumentality. The two-factor repeated-measures MANOVA did not show any significant main effects or interactions. Participants' perceived instrumentality was $M=4.11$ for the pre-test, and $M=4.18$ for the post-test, indicating that they believed instructional planning to be slightly more important than "very important" both before and after the use of MIMIC.

Performance Performance was analyzed through a two-factor MANOVA, with each of the four sub-scores and the total score as the dependent measures, with instructivist (present, absent) and constructivist (present, absent) as the two between-subject factors. Results revealed no main effects or significant interactions for the total performance score or each of the four sub-scores. The total performance score ranged from 4-20, with the overall average of $M=13.71$, $SD=4.10$. Descriptive statistics for the sub-scores were as follows: goals/objectives --$M=3.38$, $SD=1.32$; procedure-- $M= 3.30$, SD 1.10; assessment -- $M=3.26$, $SD=1.29$; and, holistic -- $M=3.23$, $SD=1.14$. Based on the total performance score, participants were categorized as high performers if they scored in the top quartile (total score of $M=16$ and above), and low performers if they scored in the bottom quartile (total score of $M=10$ and below).

Agent value Agent value was assessed in several areas, as listed below.

Enjoyment in working with agent. Participants tended to enjoy working with both agents ($M= 2.63$ for instructivist agent and $M=2.64$ for constructivist agent), where 2="A little" and 3="Very much." A non-significant t-test of the two groups (those with constructivist present versus those with instructivist present) revealed that participants reported finding both agents to be equally enjoyable. *Attending to agent*. Participants tended to pay attention to both agents ($M= 3.05$ for instructivist agent and $M=3.21$ for constructivist agent) where 3= "usually" and 4="always". A non-significant t-test of the two groups revealed that participants reported paying relatively equal attention to both agents. *Usefulness of agent*. Participants tended to report that both agents were useful ($M=3.02$ for instructivist agent and $M=3.08$ for constructivist agent) where 3="useful" and 4="very useful". A non-significant t-test of the two groups revealed that participants reported finding both agents equally useful. *Agreement with agent*. In terms of whether participants agreed with the agents' advisements, answers were coded as yes=1 and no=0, and results show that participants tended to agree with both of the agents' suggestions, $M=.67$ for instructivist and $M=.84$ for constructivist. A non-significant t-test of the two groups revealed that participants reported not agreeing significantly more or less with either agent.

Discussion

Overall, the results indicate that the presence of the constructivist pedagogical agent affected pre-service teachers' metacognitive awareness of instructional planning in multiple ways: through a change in perspective, less reported reflection, and through the underlying pedagogy of their instructional plans.

It is speculated that increased awareness about instructional planning would lead to a richer and more comprehensive understanding of the planning process, leading pre-service teachers to develop an appreciation for the process. As stated by Marton and Booth (1997),"of prime interest is the variation in the ways in which people are capable of experiencing various situations or phenomena. If one becomes aware that something is in a certain way, they also become aware that it could be in some other way" (p.207). Eventually, it would be expected that this change in perspective and understanding of the depth and complexity of instructional planning could lead to better performance and/or increased intrinsic motivation related to the task.

The presence of the constructivist agent tended to change participants' perspective toward instructional planning. Although participants had been introduced to the constructivist approach as part of the course in which they were enrolled, it still may have been experienced as a novel and unique approach. Given that some pre-service teachers describe instructional planning negatively, using adjectives such as "boring," or "tedious" (Kitsantas & Baylor, 2001), the constructivist approach may have been perceived as offering something new and providing more options for instructional planning. Further, the presence of the constructivist pedagogical agent could have been perceived to highlight more appealing elements of instructional planning (such as a student-centered focus or responsibility of the learner).

While the two-agent condition (given that it had the constructivist agent present) was more transforming than the instructivist only or no agent conditions, it was not found to lead to a significantly greater change in perspective than the other three agent conditions, as was predicted. The fact that the presence of two agents simultaneously was not perceived as the most transforming in terms of a change in perspective could be an issue of cognitive load. As Sweller and colleagues suggest (Sweller, van Merrienboer, & Paas, 1998) "less is best" in learning situations, indicating that in this case the learners may be too focused during problem solving to process suggestions from multiple agents.

The finding that the presence of the constructivist agent led to less reflection seems at first incompatible with the finding that the constructivist agent led to a greater change in perspective. However, when the constructivist agent was present, perhaps participants were focusing their attention on its ideas/suggestions rather than reflecting on their own cognitive processes. In other words, it seems viable that the presence of constructivist agent facilitated pre-service teachers to think more (i.e., change perspective), but not necessarily to reflect more. While there is strong evidence that reflection during instructional activities is important (Chi & VanLehn, 1991; VanLehn, Jones, & Chi, 1992), there is less information regarding the relative value of reflection as compared to awareness. Future research should include an open-ended follow-up question to determine what pre-service teachers actually meant by reporting less reflection.

The presence of the constructivist agent was also associated with participants' developing more constructivist-oriented instructional plans, reflecting a "trickle down" effect of the agent's pedagogical beliefs to the participants. Although there was not a main effect where the presence of the instructivist agent was related to lower underlying pedagogy score (thus indicating a more instructivist-oriented underlying pedagogy in the instructional plans), there were numerical differences showing that the presence of the instructivist was associated with lower scores in this area, indicating that in both cases (presence of instructivist and presence of constructivist) the pre-service teachers internalized the agent's suggestions and translated them in their instructional plans.

Overall, the agents were perceived by the pre-service teachers to be valuable as mentors. Participants reported neither agent to be "better" or "worse" in any of the following aspects: enjoyment of working with agent; paying attention to agent; perceived usefulness of agent; and, credibility of agent. Further, the pre-service teachers who received both agents were equally split as to which agent made them think the most, which thought the most like them, and which of the two agents they would choose to assist them (if could choose only one). Agents were rated as equally useful, they also were paid equal attention, and were equally enjoyable with which to work.

While there were no explicit differences between the agents in terms of value, there were differences in the effect of the agents on attitude. Contrary to what was hypothesized, it was found that the presence of the instructivist agent led participants to report significantly lower dispositions regarding instructional planning. Given that the instructivist agent represents a systematic approach, perhaps students felt it was too prescriptive, and made the instruction and/or planning process seem tedious or boring. While there were no main effects on self-efficacy for the presence of the agents, self-efficacy increased for participants using the MIMIC system, suggesting a practice effect. A reason that may explain why there were no effects of the agents on perceived importance of instructional planning could be that participants started with already-high ratings (rating it on average as slightly more important than "very important").

There were no main effects of the agents' presence for the overall performance score which was expected given that related research has not provided evidence that animated agents improve learning (Dehn & van Mulken, 2000). Further, the MIMIC agents provided suggestions regarding the underlying pedagogic rationale for different aspects of the planning process, not solutions. While these advisements were content-specific, they did not specifically prescribe or show the students exact implementation.

In terms of the overall implications, there is preliminary evidence to suggest that the exposure to constructivism as an instructional planning process adds richness, diversity, meaning and interest. While the instructivist approach adds substance and structure to the process, it may negatively affect disposition. If only one perspective could be provided to enrich their awareness of instructional planning, exposure to the constructivist approaches may be most beneficial, especially if the pre-service teachers already have a strong foundation in instructivist approaches to instructional planning.

Future research could implement the study with more advanced pre-service teachers or instructional designers, to determine how the agents impact them in terms of awareness of and attitude towards instructional planning. Another way to explore a change in awareness could be through including epistemology profiles to determine if pre-service teachers epistemic beliefs change as a result of using the system. The role of reflection needs to be further investigated through more open-ended questions and to systematically evaluate the agents for their self-regulatory features to determine what promotes monitoring and evaluation and how they relate to what the participant terms "reflection." Cognitive load as an explanation for the impact of two agents needs to be further examined with more advanced students, who may be able to better manage receiving advisements from multiple agents.

Overall, this study validated the effectiveness of an agent-based approach as a research process to investigate teaching and learning by simulating human-like mentoring via pedagogical agents (Baylor, in press). The instructivist and constructivist agents within MIMIC provided an indirect and meaningful way to investigate students' affect and beliefs toward instructional planning.

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Introducing the IPSRT (Instructional Planning Self-Reflective Tool) and CPSRT (Constructivist Planning Self-Reflective Tool): Self-Regulatory Tools to Promote Instructivist and Constructivist Instructional Planning for Preservice Teachers

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Abstract

The Instructional Planning Self-Reflective Tool (IPSRT) and the Constructivist Planning Self-Reflective Tool (CPSRT) were developed to facilitate self-regulation during instructional planning for pre-service teachers. We developed the IPSRT tool to promote the adaptation of traditional instructional planning methods and the CPSRT tool to promote the use of effective constructivist planning principles for pre-service teachers. This paper will present the two tools and provide suggestions based on empirical research for instructors of teacher preparation programs on how to assist pre-service and in-service teachers to become self-regulated instructional planners.

Introduction

Instructional planning is a key element of the teaching process. Teacher preparation programs spent a significant number of hours instructing pre-service teachers how to write effective instructional plans. Two major theoretical perspectives, the instructivist and the constructivist approaches to instructional planning, are implemented by colleges of education to prepare future teachers. However, writing an instructional plan for a specific student population requires more than knowing the essential elements that constitute an effective instructional plan. It requires the teacher to use self-regulatory processes, especially self-monitoring and self-evaluation that will enable him/her through reflection to tailor the instructional plan to the needs of the particular group of students.

Description of the Two Tools

IPSRT (Instructional Planning Self-Reflective Tool)

We developed the Instructional Planning Self-Reflective Tool (IPSRT) based on both research on self-regulated learning (e.g., Zimmerman, 2000) and the Reiser & Dick (1996) instructional planning model. It was designed to facilitate teachers' self-monitoring and self-evaluation during instructional planning. See Baylor, Kitsantas & Chung (2001) for the complete tool.

The major headings for the IPSRT were determined according to the Reiser & Dick (1996) instructional model: instructional goal, objectives, materials/preparation, learner characteristics, procedure, and assessment. Under the heading for objectives, there are specific subheadings for the four basic components of an instructional objective: audience, behavior, condition and degree. Under the heading for procedure, listed are the six subheadings of instructional elements: motivating students, informing students of objectives, helping students recall prerequisites and presenting information and examples, providing practice and feedback and summarizing the lesson. These are considered the necessary steps for developing instructional activities. An additional section was added for users to self-evaluate the quality of the overall instructional plan. Under each subheading, the IPSRT consists of questions with prompts to remind the users of what should be included in a traditional instructional plan.

We initially tested the IPSRT with 175 pre-service teachers, who were enrolled in seven sections of an "Introduction to Educational Technology" course and used the IPSRT tool to construct several instructional plans. These pre-service teachers were asked what was helpful about using the tool for instructional planning. Eighty-percent of participants reported that the IPSRT was useful for self-monitoring, 75% stated it was useful for self-evaluation, and 25% mentioned that it was beneficial for organization (Baylor, Kitsantas & Chung, 2001). Given that the IPSRT was developed specifically for self-monitoring and evaluation, the results supported its value as a cognitive tool in these two areas.

The Constructivist Planning Self-Reflective Tool (CPSRT)

We designed the Constructivist Planning Self-Reflective Tool (CPSRT) on the basis of research on self-regulated learning (Zimmerman, 2000) in association with the constructivist approach to instructional planning (Jonnasen, 1999). It was developed as a "Learning Support Plan" to support pre-service teachers in defining the key characteristics of an effective constructivist learning environment. See Kitsantas, Baylor & Hu (in press) for the complete tool.

It is organized according to three phases. The first phase "Before" (for activities prior to the implementation of instruction), includes the instructional purpose, and defines learning activities with both required and desirable characteristics. The required characteristics of learning activities refer to constructivist features such as the importance of cognitive activity and the focus on the learning process as opposed to acquiring specific knowledge. The desirable characteristics contain the attributes such as ill-structured tasks, definition by learner and the social environment for the activities. The second phase "During" (for activities during the implementation of instruction), describes the role of the student and the instructor, e.g., students should be active in the learning process, students should take the major responsibility for their learning, and teachers act as facilitators of the learning process. The third phase "After" (for activities following the instruction), comprises the assessment of students' learning, which also emphasizes the activity-based nature of the constructivist approach by examining if the assessment measures the instructional goals and involves some sort of performance by the learner. This tool does not specify what needs to be included in the instructional plan, but rather provides suggestions for consideration within the constructivist framework.

We tested the CPSRT tool with approximately 150 pre-service teachers, who were registered in eight sections of an "Introduction to Educational Technology" course. The results of the evaluation show that this tool is constructive for self-evaluation, organization, monitoring, and cognitive flexibility. Thirty eight percent of participants reported that the CPSRT was useful for monitoring, 38% stated it was convenient for self-evaluation, and 33% mentioned that it was effective for organization, and 31% commented that it is beneficial for cognitive flexibility (Kitsantas, Baylor & Hu, in press). As compared to the IPSRT, the CPSRT is valuable for promoting cognitive flexibility (Baylor & Kitsantas, 2001), which is a critical component for the constructivist planning approach.

Recommendations for use

Based on empirical research, the following recommendations are presented for instructors using the two tools for instructivist and/or constructivist approaches to instructional planning.

IPSRT is useful for pre-service teachers who have limited experience in teaching because it provides them with systematic procedures to follow.

Pre-service teachers may not be very familiar with the instructional elements that are necessary for an effective instructional plan. The IPSRT is good for traditional instructional planning because it is well structured, and the organization provided by the IPSRT tool is consistent with the step-by-step nature of traditional classroom instruction. The IPSRT can serve as a checklist for inexperienced pre-service teachers to make sure that they have included all the necessary instructional elements of a instructional plan.

The IPSRT includes a number of questions with check boxes for the pre-service teacher to review whether each area is covered in his/her current instructional plan. For example, when writing an instructional plan, pre-service teachers do not always include the four major components of instructional objectives. The questions in the objective part of the IPSRT tool not only remind the users of these critical sections of an instructional objective but also give pre-service teachers a recap on the important characteristics of these elements. See the following excerpt:

OBJECTIVE(s):

- Are all four of the following components present for each objective?
  ☐ yes ☐no
  1. Audience
  - Does this component state who will be doing the performance? ☐ yes ☐no
  2. Behavior
  - Is the behavior measurable and observable? ☐ yes ☐no
  3. Condition
  - Is the context for the behavior specified? ☐ yes ☐no
  4. Degree
  - Does this component clarify how well/to what extent the performance must be done?
    ☐ yes ☐no

The IPSRT tool is especially helpful when pre-service teachers are concerned or having difficulty with writing instructional plans. Instructors of pre-service teachers can provide the IPSRT tool as a job aid for their in-class or take-home instructional planning practice. With the tool in their hands, the instructor can review the instructional elements with the pre-service teachers and then explain how they can use the tool to monitor and reflect on their own instructional plan composition. Once they understand how to use the tool, they should be able to focus on the content of the instructional plan instead of unnecessarily worrying about missing any instructional elements in the structure. Further, it has been shown that the use of the IPSRT is best introduced and used prior to introduction of the CPSRT to serve as a strong foundation in systematic methods of instruction (Baylor & Kitsantas, 2001).

The IPSRT enhances pre-service teachers' intrinsic motivation for instructional planning

Pre-service teachers often have limited knowledge and skills writing instructional plans, and are much less confident than experienced teachers. We found in an experimental study with the IPSRT (Kitsantas & Baylor, in press) that pre-service teachers tend to have negative attitudes initially about instructional planning. During the experiment with 175 pre-service teachers, partially designed to assess the pre-service teachers' dispositions towards instructional planning, participants were asked to list two adjectives to describe their thoughts regarding instructional planning. We found that participants who did not use the IPSRT were slightly negative towards instructional planning whereas participants who used the IPSRT were positive. Some of the positive adjectives used by the participants were "organized," "helpful," "important," while some of the negative adjectives were "time-consuming," "tedious," "boring," This finding is a powerful empirical evidence of the positive effect of using the IPSRT tool to improve pre-service teachers' disposition towards instructional planning.

Pre-service teachers' self-efficacy, defined as the degree to which they feel competent in writing an instructional plan, is also affected by the use of the IPSRT. Pre-service teachers that initially reported high self-efficacy beliefs to write an instructional plan, following use of the IPSRT, realized that instructional planning is a far more complex activity than they originally thought. On the other hand, pre-service teachers initially reporting low self-efficacy beliefs to write an instructional plan, felt more confident after using the IPSRT (Kitsantas & Baylor, in press). These findings suggest that this tool serves as a reflective mechanism for high self-efficacious learners who believe that they have the skills to write effective instructional plans, and enhances the motivation of those who believe that they lack the skills to succeed in this task.

With the IPSRT tool serving as a job aid or cognitive tool, pre-service teachers may expend more mental effort to writing the content of the instructional plan, allowing for the development of more effective and creative instructional plans. Furthermore, the improvement in their performance in instructional planning as well as the self-evaluation conducted by pre-service teachers using the IPSRT will positively reinforce the pre-service teachers, and may make them feel more confident and motivated in carrying out this task in the future.

The IPSRT promotes a greater metacognitive awareness of the complexity of instructional planning

The IPSRT is also beneficial to pre-service teachers because it functions as a guide for users to monitor and evaluate their performance, thereby improving metacognitive awareness. The prompt questions in each subheading help the pre-service teachers examine the adequacy, clarity and accuracy of their instructional plan content.

From a micro-perspective, pre-service teachers may have difficulties applying the necessary skills within each instructional planning phase (e.g., writing objectives, formulating test items). From a macro-perspective, pre-service teachers do not always understand how the phases are interrelated and interconnected in the process of instructional development. Frequently pre-service teachers see the process as incremental (e.g., the individual phases or tasks) and fail to see the global aspect of the overall planning model. For example, when evaluating their objectives with the IPSRT, it guides them on the micro level in writing learning objectives using the four components such as audience, behavior, condition and degree, while at the same time relating this particular micro-level part to the macro-level structure of instructional goal section by asking "Does each objective derive directly and logically from one of the instructional goals?" Pre-service teachers improve their critical thinking skills by alternating between the two levels. Therefore, the IPSRT is designed to facilitate the use of self-regulation strategies from both the macro and micro perspective, listing specific strategies within each component of the instructional plan and strategies referred to the overall connectivity and holistic value of the instructional plan respectively.

The CPSRT provides exposure to constructivist methods of instruction for pre-service teachers.

Constructivism represents a very different approach to instructional planning. Most of the pre-service teachers are novice to the constructivist principles about instruction. The structure of the CPSRT tool and the prompt questions in each phase are representative of typical constructivist instruction characteristics. The CPSRT can thus figuratively serve as a "menu of ideas" for inexperienced pre-service teachers to select appropriate instructional elements of a constructivist instructional plan. Not only does the CPSRT provide exposure to constructivist methods, but also it was found to facilitate self-efficacy in the process (Baylor & Kitsantas, 2001).

The following excerpt illustrates that in a constructivist approach learners need to be cognitively active and take responsibility for the learning process whereas the instructor should try to facilitate the learning process instead of directly imparting knowledge.

Role of Student

- Are the students
  - Engaged and cognitively active? ☐ Yes ☐ No
  - Taking responsibility for learning? ☐ Yes ☐ No

Role of Instructor

- Is the instructor
  - Facilitating learning rather than directly teaching?
    ☐ Yes ☐ No
  - Encouraging student ownership of the process? ☐ Yes ☐ No

The CPSRT promotes cognitive flexibility, a key component of the constructivist approach

In contrast with the IPSRT tool, which provides a checklist for necessary elements of a instructional plan, the CPSRT tool offers a reservoir of suggestions from which users can choose (Baylor & Kitsantas, 2001). The prompt questions in this tool do not provide definitive answers, but rather offer a space for users to expand their creativity and imagination within the framework of constructivist principles. The flexibility provided by the CPSRT tool is consistent with the less-structured and activity-based characteristics of the constructivist instruction.

The following excerpt about learning activities illustrates the flexibility of the CPSRT tool. An activity will be considered desirable for constructivist learning if any or all of the boxes are checked. The list of the check box questions provides various options for the user to choose or/and build upon. Pre-service teachers will not feel limited by having to come up with only one specific type of activity. Instead, they conveniently have a list of different types of appropriate characteristics for the instructional activities.

Desirable Characteristics

Are the activity(ies):

- Ill-structured tasks? ☐ Yes ☐ No
- Complex? ☐ Yes ☐ No
- Multi-disciplinary? ☐ Yes ☐ No
- Involving cognitive conflict? ☐ Yes ☐ No
- Including discussion and/or collaboration? ☐ Yes ☐ No

Conclusions

We found that the two tools improve instructional planning performance for plans developed according to the systematic (IPSRT) and constructivist (CPSRT) approaches (Baylor & Kitsantas, 2001). Further, anecdotal evidence of the value of the tools includes comments from the undergraduate pre-service teachers who, after using the tools, wondered why they were not provided earlier in the course!

While both tools assist in all phases of instructional planning, they place a strong emphasis on assessment. Given that assessment is strongly emphasized as a critical factor in teacher-education programs, these tools encourage pre-service teachers to seriously consider assessment, the last phase of the instructional plan. For example, the IPSRT assists them to monitor and self-evaluate their assessment procedures, e.g., does the assessment reflect the objectives of the instructional plan? The CPSRT similarly requires them to directly link the assessment to the instructional purpose and involve the learner in appropriate performance(s).

Overall, the IPSRT and the CPSRT are useful cognitive tools for pre-service or possibly in-service teachers to promote the effectiveness of their instructional planning in a self-regulated approach. If utilized appropriately, these tools can bring about increased motivation, intellectual challenge, reduced workload, and improved performance for both pre-service and in-service teachers.

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Student Satisfaction in an Online Master's Degree Program in Instructional Technology

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Abstract

In 1999, the University of West Florida launched an online Instructional Technology master's program. Students enrolled in this online program can be divided into two groups: 1) "local" students who, for various reasons, prefer the online courses, and 2) students at a geographical distance. The purpose of this study was to identify factors influencing the satisfaction of these students with the online courses. A second purpose was to ascertain any difference in satisfaction levels between the two groups. The Biner instrument (1993) was modified to accommodate questions relating to online courses. Fifty-two respondents from a sample of 200 participants completed the online survey. The results indicated student satisfaction in online courses is influenced by three constructs: instructor variables, course management, and technical issues. The statistical analysis did not reveal significant differences in satisfaction between the two groups. However, when the researchers compared the differences in distribution of responses between the two groups, some interesting differences were found.

Introduction

Distance learning is defined as instruction where "students and teachers are separated by distance and sometimes by time" (Moore & Kearsley, 1996, p. 1). Many higher education institutions today are either offering online courses and degree programs or are planning such initiatives. In 1997-98, 34% of postsecondary educational institutions offered distance education courses and 20% planned on offering distance courses by 2000. Of these institutions, 77% indicated they used the Internet as one of many instructional delivery modes (National Center for Education Statistics [NCES], 1999). Many universities now offer a wide range of online courses and degree programs (Laws, 1996). For example, in 1994-95, 51% of postsecondary educational institutions in the U.S. offered more than ten distance education courses; only 4% did not offer this type of courses (NCES, 1998).

Enrollment in these courses has increased dramatically in the 1990s (Neeley, Niemi, & Ehrhard, 1998). In the academic year 1994-95, formal online student enrollment was 758,640 (NCES, 1998). By 1997-98, that number had increased to 1,661,100 (NCES, 1999). The growth in distance education is largely credited to the availability of technology-enhanced instruction (Hobbs & Christianson, 1997).

Historically, retention of distance learners has been problematic with dropout rates disproportionably high compared to traditional course settings (Richards & Ridley, 1997; Wetzel, Radtke, & Stern, 1994). A dropout rate of 30 to 50 percent was not uncommon (Moore & Kearsley, 1996). Students may experience feelings of isolation in distance courses compared to prior face-to-face educational experiences (Shaw & Polovina, 1999) because of limited contact with instructors and fellow students. The result of this isolation can be unfinished courses or degree programs (Keegan, 1990).

Student satisfaction in traditional learning environments has been overlooked in the past (Astin, 1993) and has not been explored sufficiently (DeBourgh, 1999; Navarro & Shoemaker, 2000). Student satisfaction has also not been given the proper attention in distance learning environments (Biner, Dean, & Mellinger, 1994). Many current distance learners are "non-traditional students"—adults who have important commitments such as raising a family and maintaining full-time employment (Richards & Ridley, 1997). Non-traditional learners may differ from traditional learners in reporting satisfying experiences. According to Donohue and Wong (1997), further research should be conducted to investigate causes of satisfaction in non-traditional students. Richards and Ridley (1997) also suggest further research is necessary to study factors affecting student enrollment and satisfaction.

Prior studies in classroom-based courses have shown there is a high correlation between student satisfaction and retention (Astin, 1993; Edwards & Waters, 1982). Studies in which distance learners were the target population have yielded similar results (Bailey et al., 1998).

Many studies comparing distance education to traditional face-to-face instruction have focused on factors such as attrition, effectiveness, locus of control, different media, and student achievement (Bailey, Bauman, & Lata, 1998; Navarro & Shoemaker, 2000; Richards & Ridley, 1997; Sankaran, Sankaran, & Bui, 2000; Schutte, 1996; White, 1999; Wideman & Owston, 1999). However, research comparing "local" distance learners (those who could attend on-campus classes) to students who are geographically "distant" is limited.

In August of 1999, the University of West Florida (UWF) launched an online Master of Education degree program in instructional technology. Faculty members who teach these online courses employ a full complement of tools and strategies. Students enrolled in this online program can be divided into two groups: 1) local students, and 2) students at a geographical distance. The purpose of this study was to identify factors influencing the satisfaction of these students with the online courses. A second purpose was to identify any difference in satisfaction levels between the two student groups.

Review of Literature

Student Satisfaction

Most college students spend considerable time, money, and effort in obtaining a quality education and perceive their postsecondary educational experiences as being of high value (Knox, Lindsay, & Kolb, 1993). Satisfaction is an important "intermediate outcome" (Astin, 1993, p. 278). Student satisfaction is important because it influences the student's level of motivation (Chute, Thompson, & Hancock, 1999; Donohue & Wong, 1997) which is an important psychological factor in student success (American Psychological Association [APA], 1997). Bean and Bradley (1986) found student satisfaction has a significant effect on performance. Conversely, performance does not affect student satisfaction.

According to experts, satisfaction is a good predictor of academic success (Donohue & Wong, 1997) and retention (Astin, 1993; Edwards & Waters, 1982). Elliott (1999) notes postsecondary educational institutions must retain existing students in order to achieve the goal of maximum growth. Therefore, educational institutions must focus on student satisfaction in order to increase retention (Astin, 1993). A postsecondary educational institution may also use student satisfaction as one measure of its success (Knox et al., 1993).

Student satisfaction can be defined as the student's perception pertaining to the college experience and perceived value of the education received while attending an educational institution (Astin, 1993). However, a problem exists with measurement of this important outcome (Williams & Ceci, 1997). Course evaluations, which usually intend to measure the student's satisfaction with a course, may not be valid instruments. For example, in a study students rated the instructor's content knowledge based on perceptions of enthusiasm and on presentation style. They rated the course based on how much they thought they had learned, which did not actually correlate with the amount they had learned. The researchers also reported the overall course rating was strongly correlated with the final grade received in the course. Despite these problems, surveys administered to distance learners after a course has been completed can give evaluators valuable information pertaining to satisfactory or unsatisfactory aspects. In turn, this information can then be used to improve the course or program (Chute et al., 1999).

Distance Education

Many advantages and disadvantages exist for distance learners. A key advantage is convenience and flexibility for learners. This is particularly true for adults who must schedule coursework around family and career obligations. Distance education courses are often self-paced. With the use of asynchronous communication tools, learners have access to content, instructors and classmates at all hours (Belanger & Jordan, 2000). Another advantage for online learners is they have more time to reflect and formulate their responses in chat rooms or threaded discussions compared to learners in a classroom-based course (Moore & Kearsley, 1996). This particularly benefits students who may be reluctant to speak in a classroom setting.

Students with limited access to higher educational opportunities also benefit from distance education. Learners who live in remote or rural areas or who are restricted in mobility can access online courses. Others may need access to specialized courses, degree programs, or professional certificates not available in the area in which they live. Some students may not want to attend the local colleges or universities, and distance education gives them a choice of institutions to attend. Another advantage includes the increased access to experts in the field via telecommunications (Belanger & Jordan, 2000; Hara & Kling, 2000).

Disadvantages for the learners are loss of direct interaction with the instructor and possible loss of motivation to complete the course or program (Belanger & Jordan, 2000). When students are not familiar with the technology used in the course, it can be difficult for them to catch up with the rest of the group (Vrasidas & McIsaac, 1999). It can also be difficult to enable effective group collaboration and discussion. Access to resources such as the campus library can be problematic as well. In addition, the potential for disruptive technical problems is an important factor (Belanger & Jordan, 2000).

Software programs used to facilitate collaborative learning have been used successfully in online courses. Navarro (2000) reports many students are highly satisfied with online courses. Hiltz (1993) reports that communications software increased the quality of instruction, raised students' level of motivation due to greater access to instructors, and increased their satisfaction with outcomes. Powers, Davis, and Torrence (1999) also report high student satisfaction with their level of involvement in a graduate instructional technology course.

In a study by Bower and Kamata (2000), 84% of students indicated they were highly satisfied or satisfied with their online courses experience. Richards and Ridley (1997) found the majority of students who completed online courses were satisfied with their experiences and rated courses comparable to classroom-based course. In a study comparing an online and traditional introductory psychology course, researchers found students in the online course were satisfied with the course and rated the communication with the instructor as better than in a classroom-based course. However, the students in the classroom-based course indicated they were overall more satisfied than students in the online course (Maki, Maki, Patterson, & Whittaker, 2000).

Some studies have reported decreased student satisfaction in online courses. Online students have reported needing to work harder in an online course compared to a course in the traditional setting (Maki et al., 2000). Students have also reported anxiety, confusion, and frustration with online courses (Hara & Kling, 2000). Some students reported feeling isolated and they had problems overcoming the distance (Wegerif, 1998).

Factors Contributing to Student Satisfaction

In traditional settings, areas associated with student satisfaction are student characteristics, quality of relationships with faculty, curriculum and instruction, student life, support services, resources, and facilities. A study with undergraduate students by Astin (1993) identified the following factors as most important: contact time with faculty members and administrators, availability of career advisors, student social life on campus, and overall relationships with faculty and administrators. Bean and Bradley (1986) concluded the best predictors of student satisfaction are academic integration, institutional fit, quality and usefulness of education, social life, and difficulty of program.

The instructor is the main predictor in course satisfaction (Finaly-Neumann, 1994; Williams & Ceci, 1997). Student satisfaction is highly correlated with the performance of the instructor, particularly with his or her availability and response time (DeBourgh, 1999; Hiltz, 1993). Instructors must be available if students have questions and must be flexible (Moore & Kearsley, 1996). The instructor not only becomes a facilitator of learning but also a motivator for the student.

The instructor's feedback is a key factor in satisfaction with the instructional environment (Finaly-Neumann, 1994). Feedback on assignments must be given in a timely manner to keep learners involved and motivated (Smith & Dillon, 1999). Communication must be on a regular basis (Mood, 1995). Otherwise, students can experience a great level of frustration (Hara & Kling, 2000). Distance learners can experience feelings of isolation, and high levels of frustration and anxiety if communication and interaction between the different parties are lacking (Mood, 1995).

Mood (1995) reports that course goals and objectives should be clearly communicated to the students at the beginning of the course. If students know what is expected of them, their levels of anxiety can be reduced. Instructors should encourage student participation, provide updated information, and monitor student progress. Students should also have opportunities to become self-directed learners and structure their own learning experiences (Wegerif, 1998).

Students must have access to reliable equipment (Belanger & Jordan, 2000). Students with limited access are at a considerable disadvantage to learners who have unlimited access (Wegerif, 1998). Access is one of the most important factors influencing student satisfaction (Bower & Kamata, 2000). Online learners must be familiar with the technology used in the course in order to be successful (Belanger & Jordan, 2000). Students who experience frustrations with technology in a course report lower satisfaction levels (Chong, 1998; Hara & Kling, 2000).

Navigational components are also important issues in the online environment. Learners should be able to move within the course Web site without getting lost (Aggarwal, 2000). Hyperlinks must work properly or students will experience frustration (Harrison, 1999).

Learning environments in which social interaction and collaboration are allowed and encouraged lead to positive leaning outcomes (APA, 1997). Collaborative learning tools can improve student satisfaction in the online learning environment (Bonk, 1998; Gunawardena & Zittle, 1998). These tools allow for group work and immediate feedback. Students are able to share viewpoints and discuss them with one another in a virtual environment, thereby gaining insights and perspectives they otherwise would not have been exposed to. This type of environment allows for social interaction and creates meaningful, active learning experiences (Bonk, 1998).

Methodology

The University of West Florida was founded in 1963 and is located in the Florida Panhandle. The main campus is located in Pensacola, Florida. In 1993, the Fort Walton Beach campus was established approximately 50 miles east of Pensacola. The university offers many courses utilizing two modes of distance learning including online courses and interactive video courses.

Total university enrollment is approximately 9,000 students.

In 2000-01, the university's total enrollment was 8,517 students. Graduate and doctoral students make up 16% of the student body. The College of Professional Studies has 791 masters and doctoral students (University of West Florida, 2001).

Sample

The sample used in this study was drawn from a pool of all graduate distance learners (507 students) at this university. The researchers decided to split the population in two groups: "local" and geographical "distant" students. Zip codes of students' residences were used to make the distinction between the two groups of students. A "local" student was defined as anyone with a zip code starting with "325". A "distant" student was defined as anyone with any other zip code. The use of this criteria resulted of a sample of 363 "local" and 144 "distant" students. A total of 100 students were randomly selected from each of the two groups.

Instrument

The Telecourse Evaluation Questionnaire (Biner, 1993) has a total of 42 questions. This instrument measures student attitudes toward televised distance education and addresses three factors: (1) instruction and instructor, (2) technology, and (3) course management. With permission, the researchers modified the survey to address issues related to the online environment and student satisfaction. In order to eliminate neutral responses, participants were asked to indicate their level of satisfaction on a 4-point Likert scale ranging from "1 = strongly disagree" to "4 = strongly agree." The researchers added several questions relating to general information such as age, major, final course grade, hours per week spent on the course, and Internet access issues. The researchers also added four open-ended questions, asking the most and least satisfying aspects of the course, eason for enrollment, and factors that could improve student satisfaction. Because this survey was significantly modified to adapt the technology used in Web-based courses, the researchers performed a reliability analysis after the data collection phase.

Data Collection

The online survey was constructed and uploaded to a server. A personalized e-mail was sent to the participants with instructions on accessing and completing the survey. The researchers provided participants with the purpose of the research, a statement addressing confidentiality and voluntary participation, and contact information of one of the researchers. Initially, the return rate was 21.5%. After six days, all participants were reminded via e-mail to complete the survey, which resulted in a final response rate of 26% (52 participants).

Data Analysis

The data was examined for statistical assumptions (e.g. sample size and missing data, linearity, multicollinearity, singularity, univariate and multivariate outliers). None of the cases had missing values. Each group was examined separately for outliers. Examination of the scatterplots revealed no univariate outliers. A Mahalanobis distance test, $?^2 = 22.46$ at $p < .001$, was performed and no multivariate outliers were detected. In order to examine for linearity, several bivariate scatterplots were generated and examined. All of the scatterplots revealed abnormalities between the variables due to the instrument being a 4-point Likert scale.

The Pearson correlation coefficients were examined in a correlation matrix in order to determine if multicollinearity existed. Many correlation coefficients exceeded .50 and the highest correlation coefficient detected in this matrix was .91. The collinearity diagnostic demonstrated variance proportions were below .64 and this leads to the conclusion that no multicollinearity existed between any of the dependent variables. Each dependent variable was an independent measure, therefore ruling out singularity.

A confirmatory factor analysis was performed to subtract factors relevant to student satisfaction as identified in the literature and to examine the construct validity of the satisfaction survey. The researchers expected six factors with high subscale loadings for the online course satisfaction survey. An initial examination of the data revealed eight dimensions which had eigenvalues greater than 1. The examination of the scree plot, however, indicated the instrument has only three components.

The factor loadings on the instructor/instruction satisfaction dimension were satisfactory and explained 50.12% of variance. The other two components had several complex loadings. A possible explanation is students associated many of the course management aspects with instructional issues and the online learners might have associated technology aspects with factors outside the course. However, these results indicate the online course satisfaction survey is a true measure of satisfaction.

Descriptive measures were calculated for each item on the online course satisfaction survey. A *t*-test for independent samples with an alpha level of .05 was performed to determine if differences in responses between groups were statistically significant. The survey was then collapsed into six subscales: instructor, technology, course management, course Web site, interactivity, and general issues. Respondents' scores were summarized and divided by the number of questions in each of the subscales and a multivariate analysis of variance (MANOVA) was performed. Then, the subscales where collapsed again without dividing the computed scores in order to avoid losing variance and a MANOVA was performed a second time to detect statistically significant differences between the two groups. The data analysis also involved open coding of qualitative data generated with the use of open-ended questions.

Results and Discussion

The internal consistency reliability of the online course satisfaction survey was determined using the Cronbach alpha coefficient. The overall reliability of the modified instrument was high (.97).

General Survey Responses

Fifty-two students who had completed at least one online course responded to the Web-based survey. Of the respondents, 69% were female. The majority of learners were between 40 and 49 years of age. All but two respondents were Education majors. Most respondents (53.8%) lived within a 30-mile radius from a UWF campus. Twenty-one percent indicated they enroll only in distance learning courses.

Half of the participants had taken only one or two online courses at the time of completion of the survey. The participants spent an average of 12 hours per week working on course activities. The large majority of participants (86.5%) accessed the course materials from home.

Forty-six percent of the respondents indicated that they would have been able to take a course if it had not been offered online. When asked why they enrolled in an online course, the majority of participants indicated availability and degree requirements were the most important reasons, followed by convenience, and out-of-town travel during the semester. These findings are consistent with results of previous studies, in which students' reasons for enrolling in an online course were convenience, the ability to take a course which would otherwise not have been available to them, or fulfilling degree or certificate requirements (Bower & Kamata, 2000).

According to respondents, the three most satisfying aspects were acquisition or improvement of technology skills, instructor's support and responsiveness, and flexibility. The top two least satisfying aspects were lack of face-to-face contact with the instructor and students, and heavy workload. When asked what would increase satisfaction in the online course, several students responded that they could think of nothing, and they were satisfied and enjoyed the course. Some students indicated that the university should ensure students have the necessary computer skills before allowing them into online courses.

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Overall online course experience

Eighty-four percent of respondents indicated they were satisfied with the online course. Fifty-six percent were more satisfied with the online course than with a classroom-based course, and 73.1% were satisfied with the course workload. Eighty-one percent stated they would enroll in another online course. Ninety percent were satisfied with their final grade, and 90% received a final grade of "B" or higher.

Ninety percent of respondents strongly agreed or agreed with positive statements about their satisfaction with aspects of online courses such as quality of lessons, instructor's content knowledge, opportunities to participate, reliability of the university's server, course registration procedures, and external hyperlinks used in the course. Satisfaction with the instructor, reliability of computer equipment, Internet connection, administrative issues, access to resources, and course web site was indicated by more than 80% of the respondents.

Less than 25% of respondents indicated dissatisfaction with instructor feedback and teaching methods, Internet communication tools, availability of course mentor, Web site's organizational structure, and personal familiarity of technology tools used in the course. However, 58% did not agree there was more interaction between all involved parties in the online course and 48% strongly disagreed or disagreed they participated more in the online course than in a traditional classroom setting. In addition, 31% were not satisfied with the effectiveness of communication in the online course.

Differences Between Local and Distant Learners

The "distant" group consisted of more females than the "local" group: 81% and 61% respectively. Of "local" learners, 90% lived within 30 miles from a university campus. None of the "distant" students lived closer than 31 miles to a campus and the majority of this group (52%) lived between 31 to 100 miles from a campus. In the "local" group, 13% indicated they only enrolled in distance education courses, whereas one third of individuals in the "distant" group were enrolled in only distance learning courses.

None of the "local" students had taken more than nine online courses. In comparison, 20% of "distant" students had taken more than nine of these courses. Almost two thirds of "distant" students and one third of "local" students would not have been able to take the course had it not been offered online. The majority of "local" students spent more time working on the course. Of "distant" students, 67% spent between one to ten hours per week working on the course, whereas 54.9 % of "local" students spent more than ten hours.

The majority of "local" learners (45.2%) did not experience difficulties accessing the Internet. In contrast, the majority of "distant" learners (42.9%) had problems between one to three times. Of students who answered what grade they had received in the course, only two students received a grade C. These two students were "distant" students. All other students received a grade B or better.

Overall online course experience

The statistical analysis revealed no statistically significant differences between the means of the two groups at the $\rho < .05$ level. The standard deviations are relatively minor. Variables with a correlation coefficient between .60 and .80 are considered to have a strong relationship, whereas variables with a correlation coefficient between .80 and 1.00 have a very strong relationship. In Group 1, there were six relationships with a correlation coefficient higher than .60; in Group 2, six relationships with a correlation coefficient above .60 and nine relationships above .80 were detected.

When the researchers compared the differences in distribution of responses by percentages ("strongly disagree" and "disagree" versus "agree" and "strongly disagree") between the two groups, some interesting differences were found. "Local" students were generally more satisfied than "distant" students with a few exceptions. "Distant" students disagreed far less with the statement there was more interaction between all involved parties in the online course.

The "distant" group was also more satisfied with the online course compared to a classroom-based course. The technology used in the course was more familiar to them and they were more satisfied with the use of threaded online discussions or forums. In addition, they were slightly less negative about the statement they participated more in the online course than in a traditional classroom setting and were slightly more satisfied with the instructor's use of various teaching methods and techniques.

In general, "local" students were more satisfied with the opportunities given to them by the instructor to participate in the course, the instructor's communication skills, and the instructor's organization and preparation. They also indicated the instructor made them feel more like they were part of the class and belonged, and they were more satisfied with the instructor's encouragement. They agreed more with the statement the Web site was consistent and well designed and their Internet service provider was reliable. Interestingly enough, they were slightly more satisfied with the university's role in helping them get started in the course and with the accessibility of departmental program personnel. The "local" students were also more satisfied with their final grade in the course and with the quality of the weekly lessons.

Conclusions

Students in online courses face a number of obstacles. Online students who are geographically distant would theoretically have more to overcome than those who live near the institution and have ready access to the instructor, peers, and physical campus resources such as the library and computing center. This study found no statistically significant levels of satisfaction between local learners and truly distant learners in online courses. Truly distant learners did not experience less satisfaction in their online courses. Perhaps they experience more satisfaction than one would expect because they are accustomed to the technology and the environment. Perhaps they have extra motivation because they have no choice: they would not otherwise be able to take the required courses for their program of study and are therefore content with the online environment. The only alternative would be driving long distances to physical campuses to have the educational opportunities their local counterparts take for granted. This issue certainly requires further investigation.

Interesting conclusions we might draw from learners' responses to the open-ended questions are that the university should consider more preparation of students for online environment. This could be in the form of policies and procedures, orientations, and checklists of required equipment and skills. One thing an institution can provide for its distance learners is a handbook for distance students with basic institutional information, policies and procedures, and technological skills and requirements (Hardy, 1999). This is particularly important for learners who are being introduced to the online learning environment. Many of the respondents in this study had completed only one online course.

According to the participants in this study, the limited face-to-face interaction was a drawback. Perhaps it would benefit the students to schedule an in-person meeting at the beginning of the course, even though it would be potentially inconvenient for students. Because limited face-to-face contact was the most frequently cited issue that limited satisfaction, a one-time meeting and orientation for all class participants could address this problem.

One recommendation for further research is the investigation of differences in satisfaction between students who are enrolled strictly in online courses and others who take a mixture of Web-based and classroom-based courses. The sample in this study was not large enough to perform a statistical analysis because only 11 students were true distance learners. A small sample size such as this could be used for an in-depth case study with structured interviews.

Moore and Kearsley (1996) warn student satisfaction is not correlated with actual student achievement. However, the fact that satisfaction is a contributing factor in motivation, which, in turn, is a predicting factor of student success, is reason enough to be concerned about the levels of satisfaction students experience in online courses and degree programs. The increase in numbers of online courses offered at postsecondary institutions and the rising enrollment in these courses and programs should encourage researchers to investigate student satisfaction.

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Effects of Instruction Administered Through Written and Visual Symbol Systems on the Achievement of Formal and Distance Education Students

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Abstract

This study was conducted to examine the effects of instruction administered through written and visual symbol systems on the achievement, confidence, attitudes, time-on-task and retention of formal and distance education students.

The sample of the study consisted of 161 undergraduate students from formal and distance education settings. Subjects were divided into three groups and asked to study the materials during a week. First group studied the materials that included only written symbol systems, second group visual symbol systems, and the third group both written and visual symbol systems. After studying the materials, the subjects completed an achievement test and a Likert type attitude scale. Two weeks later, an identical achievement test was administered again to determine the retention of learning.

Results indicated that different forms of symbol systems had different effects on student's achievement, confidence, and retention of learning. Attitudes of subjects were positive toward the symbol systems that they studied. Especially, distance education students were positive toward both to written and visual symbol systems while formal education students were positive only to written symbol systems.

Introduction

Symbol systems in information processing are defined as symbolic representations of information and requires interrelation of varying symbol forms such as letters, numbers, formulas, figures, notes, graphics, photographs, etc (Goodman, 1976). Selection of symbol systems to use with different media depends on the nature of media and its technological limitations. Students' selection, processing, storage and recall of verbal, visual or aural symbol systems vary due to their individual differences.

Media in learning process show differences in cognitive information processing in relation to their capabilities, technologies and symbol systems (Kozma, 1991). In other words, an individual utilize varying schemata for defining, processing and storing symbol systems relevant to the characteristics of media.

The schemata in memory are coded either verbally or visually according to characteristics of symbol systems that carry information and recalled back to be used in process of learning new information. Learning occurs with processing of prior and new information in memory as an integrated entity. However, in some situations, new information may not fit into an existing schema and either a new one, appropriate for new information, is constructed or the existing schema is modified in a way that new information can suit. This modification to new information might be possible through gaining attention of students. Thus, symbol systems in instructional materials must be designed carefully to acquire students' attention (Wittrock, 1990).

In the light of this view and explanations of cognitive psychology about information processing, a shift happened in media comparison studies toward studying how learning occurs according to individual characteristics of students. So that it can be revealed how to implement instruction according to available technological facilities.

However, researchers in the field of educational technology have not reached a common consensus on which and how attributes of different media influence learning although debates have been continuing for many decades. Thus, more detailed studies are still needed to clarify this issue. This need is more crucial in the field of distance education that naturally depends on heavily mediated learning activities. The quantity and quality of research studies have done on effects of media on distance learning urges the need.

This study was conducted to examine the effects of instruction administered through written and visual symbol systems on the achievement, confidence, attitudes, time-on-task and retention of formal and distance education students. It is believed that results of the study may help especially distance learning designers and instructors provide more effective, efficient and appealing instructional media to their students.

Purpose of Study

In this investigation, it was sought to clarify the effects of using different media in both distance and formal education on learning outcomes. In other words, this study purposed to determine which symbol systems provide better achievement, higher confidence, lesser time-on-task, positive attitudes, more retention of learning, when used in distance and formal education settings. Specifically, the following research questions were addressed:

1. In which way is the use of different media and symbol systems effective on achievement of students in distance education and formal education?
2. How do distance and formal education students' attitudes toward the media they use and the content they encounter differentiate?

3. How does the use of different symbol systems influence confidence level toward achievement and retention in distance education and formal education settings?
4. Does the time students spend to complete the task differ according to instructional strategy (distance and formal) and symbol systems?
5. In which way is the use of different symbol systems effective on the retention of learning?

Methodology

This investigation included a 2X3 factorial analysis. The factors can be seen in Table 1. The effects of these dependent variables on formal and distance students' achievements, levels of self-confidence, academic attitudes, time-on-tasks and retention of learning, which is determined at the second test administered two weeks later the first one, are investigated in this study.

Table 1. Factors and Quantity of Participants

	Symbol Systems			
Instructional Strategies	Written	Visual	Written and Visual	
Distance	n = 28	n = 31	n = 28	87
Formal	n = 25	n = 24	n = 25	74
	53	55	53	N = 161

The sample of study consisted of 161 sophomore students from formal and distance education settings. 87 of these were formal education students majoring in Economics and Business Programs of Anadolu University. Others were also studying in economics and business but they were all in the distance education programs of the University.

A 138 minutes long video program and a 50 pages textbook on same topic, anthropology were used in as the instructional materials of this study. Subjects were divided into three groups and asked to study the materials during a week. First group studied the materials that included only written symbol systems, second group visual symbol systems, and the third group both written and visual symbol systems. It was also asked students record the time they spent on studying the materials. After studying the materials, the subjects completed an achievement test and a Likert type attitude scale. Two weeks later, an identical achievement test was administered again to determine the retention of learning. In addition to these, students indicated their grade expectations on both achievement tests. These were used to determine the self-confidence level of students.

In the process of data analysis, means, standard deviation, Pearson correlation, two way variance analysis and Fisher LSD test were used. Using MS Excel and Systat software completed all these statistical processes. For data analysis .05 Alpha level determined but it was also indicated when a .01 Alpha level determined.

In order to determine the effects of using different symbol systems (written, visual or combination of these) on distance and formal education students, five different instruments about achievement, self-confidence, attitudes, time-on-task and retention of learning were developed.

- **Achievement test:** After studying the materials participants took a 50 items achievement test. 50% of these items were intended to measure students recalling abilities others were comprehension abilities.
- **Self-confidence:** The students were asked to write down what grade they expect to get in the exam before they started to answer the questions. These expectations were used as their confidence levels.
- **Time-on-task:** It was demanded to keep a record of time spent for studying the materials. So that, whether a statically significant difference are there between in time spent for studying and instructional strategy (distance versus formal) or symbol systems through a two-way variance analysis.
- **Attitudes:** A 30 item Likert type instrument were developed to determine the students' attitudes toward symbol systems and the topic they studied. 15 of the items were related to the instructional media and others were about the content.
- **Retention of learning:** Two weeks later, an identical achievement test was administered again to determine the retention of learning. Same as achievement test, it was intended to determine if there is any difference between in the recalling and comprehension levels of students.

Results and Discussion

The results reached in this investigation are given below into four groups.

Achievement

Results indicated that students in face-to-face education achieved more than the students in distance education. While the groups studying only with the written symbol systems in face-to-face education are more successful, in distance education the groups studying with both written and visual symbol systems together are more successful. This finding might be implying that students use their usual learning styles when they are presented the content in a different material. In other words, using textbooks in face-to-face education as a basic resource results in students' preferring the textbooks and written symbol systems. On the other hand, the fact that students using both written and visual symbol systems in distance education are more successful comparing the other two groups may be caused by their familiarity to the media and determination of which symbol systems to use (Weinstein and Mayer, 1985).

While the remote memorization part of the achievement test imply almost the same results, the comprehension part of it, on the other hand, yields a significant difference. In the comprehension part of the achievement test, those who use both written and visual symbol systems in both traditional and distance learning are more successful than other groups. Research findings related to the effects of presentation of content via different materials and different symbol systems support the literature in general. For example, Bagget and Ehrenfeucht (1983) believed the strength of the use of verbal and visual symbol systems together in increasing the achievement. Also, Pezdek and Hartman (1983) suggest that using audio-visual information together increases the achievement, while Pluss, Leutner, Chu, and Mayer (1998) suggest visual and verbal elaboration in information processing increases the achievement. But these findings have been gathered from the learners in traditional education. On the other hand, findings of this research shows that the students who use only the written symbol systems in face-to-face education scored the highest points on the achievement test. This might be implying that the students in traditional learning usually prefer verbal learning habits in order to create connections in between their previous and new learning.

Confidence

Confidence score means of the students in face-to-face education are higher than those who are in distance education. Correlation between achievement scores and confidence scores was found to be positive and significant.

Research findings, on the other hand, show that there is a difference between successful groups and confidence levels. From the achievement perspective, the group using written symbol systems in traditional education is more successful than the group using both written and visual symbol systems in distance education. From the confidence perspective, the groups using only visual symbol systems had higher confidence levels in both traditional and distance education. This might be an indication of students' perception of visual symbol systems easier and finding the presentation of content more attractive.

Salomon (1979, 1984) compared the printed materials and television in his researches,, and suggested that television is perceived much easier compared to printed materials, but still the learning is not that strong. Similarly, Cennamo, Savenye and Smith (1991) suggest that the way students perceive the medium will make their learning either easier or more difficult depending on their abilities. In this research also, findings support that groups using only the visual symbol systems had higher confidence levels since they perceived the medium much easier.

Attitudes

Attitude score means of students in distance education are rather close to the means of students in face-to-face education. Overall attitude scores for all students are generally high. It can be said that students' attitudes toward the instructional media and content are positive.

In the media part of the attitude scale, both the written symbol systems and written-visual symbol systems groups showed more positive attitudes compared to only visual symbol systems groups. This finding yields important clues for instructional designers, teachers, program producers and textbook writers. Because adaptation to any content can only be possible by focusing on the media. This requires the design of learning materials and symbol systems in a way that they will get their attention and attract them (Wittrock, 1990).

In the content part of the attitude scale, only written symbol systems groups and written-visual symbol systems groups in distance education exhibit more positive attitudes in understanding the content. This shows that in distance education, only the visual symbol systems are not enough to affect achievement. This finding supports Pezdek and Stevens (1984).

On the other hand, groups studying only with the written symbol systems in traditional education, exhibit more positive attitudes in understanding of the content. This implies that the book is the most effective material for understanding the content. This finding supports Salomon (1984). According to him, printed materials are perceived to be requiring more efforts and investment.

Time-on-task

The time students spent on completing the instructional materials are significant in both teaching method and symbol systems variables. Distance education students spent more time than the traditional groups. Groups using written and visual symbol systems together spent more time than those using only written or only visual symbol systems. To see how these two variables effect each other, Fisher LSD test processed and according to the results, distance learning groups in both written and visual symbol systems compared to other five groups. Traditional face-to-face group spend less time to complete the material than other groups.

Looking at their achievement score means, results show that there is a positive correlation between time-on-task and students' achievement in distance written and visual groups. While the traditional written symbol group use less time for learning, still they are more successful comparing to other groups. The reason for this success of students in this group might be related to their ability levels and entry learning behavior levels. Different researches in the literature suggest that learning content from different materials and symbol systems might change as a result of their entry behaviors and abilities of students.(Eckhardt, Wood and Jacobwitz, 1991; Van der Molen and Van Der Voort, 1997; 1998). This effects student achievement either positively or negatively.

Future research is needed to see whether the findings are correlated to entry behaviors and abilities.

Result of the retention of learning test was conducted two weeks after the achievemet test. The test indicated that each group's achievement points were decreased. Formal students were more successful than the distance students at the retention test. If we look at the symbol systems' point of view, formal group students who have used symbol systems were more succesful than the other groups. Distance education students who have used the verbal and video symbol systems were more succesful than the other groups.

Recall sub division of the retention test's statistical results indicated that there were some differantiation between the achievement tests' sub divisions. Formal-verbal was the most successful group in the context of achievement-recall. In conrats verbal-visual group were the most succesful in vebal-visual context. Those results supports that the idea of visual knowledge can be stayed more than a week in memory (Bagget and Ehrenfeucht, 1983), and if visual-verbal knowledge can be presented together those knowledge effects the students' achievement (Plass, Lautner, Chun, and Mayer, 1998).

Formal written group is seen the most successful group in the comprehension sub division of retention test while the formal written and visual group is the most successful in the comprehension sub division of achievement test. On the other hand, the formal education learners' interaction level with symbol systems reveals that formal written group is more successful in retention-comprehension while formal written and visual group leads in achievement-comprehension. These findings can be interpreted as that formal education learners use mostly use verbal strategies in the mental information processing.

The responds of students related to confidence show no significant difference neither for instructional strategy nor symbol systems. Decreases can be seen in the relationship between students' actual grades and indicated confidence responses, and retention-confidence level of each group compare to achievement-confidence. Positive and significant relation between in the retention test grades and in confidence grades is also observed same as relation between achievement and confidence.

Another decrease can also be noticed in each groups' means of confidence level related to retention test when achievement-confidence means of the groups and the means of confidence level related to retention test are compared. Same as achievement test confidence means, groups studied only visual symbol systems got better confidence scores than others. According to these findings, it can be claimed that visual materials are perceived easier than printed materials.

In the light of all the findings indicated above, it can be told that use of different symbol systems for learners in formal and distance education settings shows assorted effects on learners' achievement, attitudes, confidence, time-on-task and retention of learning. So that, in order to enable learners with diverse characteristics to get benefits from various symbol systems, instructional media must be designed and utilized appropriately.

Suggestions

According to the results of this investigation and the experiences gained during the study, following suggestions are offered for both practitioners and researchers.

Different symbol systems do influence the achievement in different ways. So that, instructional designers (practitioners) should pay attention to learners' individual characteristics and distinctiveness of symbol systems in order to provide effective, efficient and appealing distance learning opportunities as well as formal learning practices in every phases of instructional design process.

As with any research effort, this one raised a number of compelling questions worth further exploration. First, distance learners' individual characteristics such as age, sex, learning style might influence the effective use of different symbol systems. Thus, people who are interested in symbol systems (researchers) in distance education can investigate the relationship between these characteristics and symbol systems.

Second, effects of learners' prerequisite skills about instructional content on distance learners' symbol system preferences is another topic worth further investigation. Third, the instructional content of this study was a social science, anthropology. The effects of symbol systems might differ on another instructional content. In other words similar investigations should be conducted in different content areas such as sciences, mathematics.

Forth, another point is that sometimes learners might find the content more important than the symbol system or vice versa. In another investigation this point might be examined to clarify in distance education.

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Community Colleges World Wide Web Home Pages: Accessibility and Design

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Abstract

The Carl D. Perkins Vocational and Technical Education Act of 1998 made the community colleges the point of access for training and education for special populations. Physical barriers are obvious problems that limit access for individuals with disabilities, and community colleges have made reasonable accommodations for individuals with disabilities. However, there are on-line barriers that limit Web-based content that have often been overlooked. This study examined the content accessibility of community college home pages. A total of 253 community college home pages were evaluated for content accessibility. Only 22.1% of the community college home pages were accessible to individuals with disabilities.

Introduction

Access and opportunity have become the hallmarks of post-secondary education. The community college extends far beyond the traditional, limited freshmen-sophomore experience and provides a setting where almost anyone can learn (Parlinchak, 1998). Community colleges serve all citizens and provide a range of services that support special populations. As the number of students continues to increase, especially among special populations, so does the need for support programs and services.

The Americans with Disabilities Act (ADA) of 1990 provides the same civil rights protection to individuals with disabilities that apply as a result of race, gender, national origin, and religion (Button & Wobschall, 1994). Title III of the ADA directs that public facilities make reasonable modifications to control discrimination and support accessibility in policies, practices, and procedures (Council for Exceptional Children, 1994). As a result of this landmark legislation, accessibility alterations such as providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the United States.

The Perkins Vocational Act of 1984 called attention to America's need to support individuals who were less fortunate by birth or economic circumstances. The Act underscored the need for improving vocational programs and serving special populations of students. The Act created an awareness of the population of people that had gone unnoticed with little or no training. This Act made community colleges the point of access for training and education for special populations.

The World Wide Web (WWW) has become an invaluable resource for many people with disabilities. Accessibility across platforms and geographic distance makes the WWW an ideal universal tool for gathering and disseminating information (Heflich & Edyburn, 1998). In fact, it is estimated that 34.4% of community colleges use the Internet to disseminate training and educational programs to special populations (Gibson, 2000). Wong (1997) discussed using the Internet for increased self-advocacy by individuals with physical impairments. It is ironic, however, that while technological developments have enhanced and provided new exciting opportunities for the WWW, they have, at the same time, complicated and limited the accessibility of the content and resources for individuals with disabilities.

Physical barriers are obvious accessibility concerns. Web page developers need to be just as aware that on-line barriers can create significant problems for some users. The Americans with Disabilities Act requires that all organizations make reasonable accommodations for individuals with disabilities. Even though there has not been a judicial ruling on WWW accommodations for individuals with disabilities, home page developers should work towards designing and building Web sites that are accessible to all individuals. It is important that Web page developers use and follow standards that allow accessibility to all WWW users.

A variety of disabilities can reduce accessibility to the WWW. Visual, hearing, movement, cognitive, speech, and other impairments can limit availability of information. Assisted technologies or accessibility aids, such as Braille output systems, keyboard modification, screen enlargement utilities, voice output utilities, and other technologies allow individuals with disabilities to access information on the WWW. However, because of the complexity of many Internet resources, some information cannot be accessed with these aids. Developers of accessibility aids continue to identify and develop features that can overcome some of these barriers, but there are many simple strategies that Web page developers can use with very little effort that would make their services more accessible.

The Trace Research and Development Center at the University of Wisconsin at Madison produced the Unified Web Site Accessibility Guidelines (Trace Research and Development Center, 1998). This information was transferred to the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) and used to produce the Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999a). The primary goal of the guidelines is to promote content accessibility. The guidelines do not discourage content developers from using images, video, and other multimedia tools; rather, they explain how to make multimedia content more accessible to a wide audience.

The Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999a) is organized around two general themes and 14 guidelines or general principles of accessible design. The themes are (a) ensuring graceful transformation and (b) making content understandable and navigable. The document provides the rationale behind the guidelines and includes some groups of users who benefit when they are applied to Web pages. In addition, a list of checkpoints is provided that explains how the guidelines apply to typical content development scenarios. Each checkpoint is specific enough to be verified, while general enough to allow Web developers freedom to use appropriate strategies.

The guidelines that primarily address the theme of ensuring graceful transformation, Guidelines 1 through 11, assist Web page developers in producing sites that remain accessible despite constraints confronted by people with disabilities. For example, Guideline 1 states that Web developers should provide equivalent alternatives to auditory and visual content. Text can be rendered in ways that are available to almost all browsing devices and accessible to all users, but auditory and visual content are not. Guidelines 12 through 14 primarily address the theme of making content understandable and navigable. This includes providing navigation tools and orientation information in pages with maximize accessibility and usability. Not all users can make use of visual clues such as image maps or graphical information, but with orientation information, users can understand many of these graphical images. The Web Content Accessibility Guidelines 1.0 document provides much more detail in developing content accessible Web pages (Chisholm & Vanderheiden, 1999a).

Building Web sites that comply with standards for accessibility should be a high priority for Web page developers. To date, little research has documented the extent to which accessibility goals have been reached. The purpose of this study is to examine the accessibility of community college home pages and provide information on making them accessible (if they are not) to individuals with disabilities.

Method

To examine the accessibility of community college home pages a descriptive study was conducted. The sampling technique used to select community college Web sites and the evaluation procedures are discussed in the following section.

Sampling

The population Web sites for this study was community colleges located in the United States. A list of 720 community college Web sites was generated using the search engine go.com (2000). A random sample of 260 community college home pages was selected for content accessibility evaluation in this study.

Procedures

Each home page was analyzed using the software package Bobby 3.2 (Center for Applied Special Technology, 2000), which allows researchers and other professionals to evaluate Web pages in accordance with the W3C Web Accessibility Initiative's guidelines. Bobby 3.2 produces a summary report that consists of (a) the number of Priority 1, Priority 2, and Priority 3 access errors, (b) user check data, (c) the types of accessibility errors, and (d) the ease in correcting the accessibility error. Priority 1access errors are problems that seriously affect the page's usability by people with disabilities and the Center for Applied Special Technology (CAST) strongly suggest that Web developer correct these errors. For a page to obtain Bobby Approved rating, the home page cannot contain any Priority 1 errors. Priority 2 access errors are considered important for access but are not as vital as Priority 1. Priority 3 access errors are third-tier access problems that a Web developer should consider correcting.

Some accessibility errors cannot be confirmed using Bobby 3.2, but Bobby 3.2 provides user check data that informs the user that manual examination and human judgment are required for examining a specific area of the home page. For example, when different font colors are detected, Bobby 3.2 identifies multiple color fonts and reports this as a user check, meaning that it may potentially be an accessibility problem. In this study the user check data was not manually examined but will be reported as potential accessibility problems.

For a full description of the types of access errors see the Techniques for Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999b). In this study only the initial home page was evaluated; that is, no links from the home page within the domain were evaluated. Scores for each home page were tabulated and further analyzed.

Results

Of the 260 community college home pages randomly selected for this study, only 253 pages were available for evaluation. Approximately three-fourths (77.1%) of the home pages (n=195) were not approved by Bobby 3.2 (2000) as content accessible. This indicates that at least one Priority 1 error (seriously affects accessibility) was detected on these pages. There was an average of 1.01 Priority 1 accessibility errors on the community college home pages. In addition, the average number of potential Priority 1 accessibility errors was 8.48.

There were three types of Priority 1 accessibility errors detected on the home pages. Most of the community college home pages (64.2%) did not provide alternative text for all images. A few of the home pages did not provide alternative text for image map hot-spots (17.3%) and did not provide alternative text for each applet (5.5%). All the Priority 1 accessibility errors were rated as easy to correct.

Almost all the home pages (99.2%) did not identify the language of the text. Approximately 90% of all community colleges home pages (a) did not specify a logical tab order among form controls, links, and object, (b) did not provide keyboard shortcuts to links, (c) did not provide a descriptive title to links, and (d) used deprecated (i.e., included elements that have been replaced by newer elements) language features. Using tables in home pages create additional types of accessibility problems. Community college home pages used tables to format text documents in columns (77.2%), did not provide a linear text alternative for tables (81.9%), and did not provide a summary and caption for tables (77.6%). Many of the home pages used movement in their images (78.7%).

Using color on home pages can create problems in differentiating items on the page. Most of the pages needed examining for foreground and background colors contrast (92.1%) and used color fonts to convey information (87.4%). The majority of sites did not use an extended description to convey information beyond what was in the alternative text (84.2%). Again, the inclusion of tables on home pages could create potential accessibility problems. Most of the home pages needed to be examined for the use of structural markup to identify their hierarchy and relationship (80.7%) and examined for the presence of headers for the table rows and columns (72.4%). When scripts are used to convey information or functionality, alternative content needs to be provided (54.3%).

Discussion

Community colleges have played an important role in the training and education of individuals with disabilities. This study provides empirical evidence that most community college home pages are not accessible to individuals with disabilities. With very little effort all the home pages could easily be corrected to eliminate the more severe Priority 1 accessibility errors.

Web developers at community colleges need to examine their Web sites for accessibility problems. It is strongly recommended that validation methods be used in the early stages of Web development, which will help make problems easier to correct and assist developers in avoiding many accessibility problems. There are two suggested methods of validating a Web page for accessibility (Chisholm & Vanderheiden, 1999a). First, automatic tools are available for scanning the site and providing data. Bobby and other validation services should be used to provide information concerning accessibility problems. Automatic tools are convenient but do not identify all accessibility issues, therefore it is recommended that each site be examined by a knowledgeable individual and individuals with disabilities to ensure clarity of language and ease of navigation. The processes of rapid prototyping and formative evaluation have been used for many years to help develop educational software and have recently proven to be useful in the process of Web site development (Corry, Frick, & Hansen, 1997). Expert and novice users with disabilities should be invited to view home pages and provide feedback about accessibility or usability problems and their severity.

Community colleges are leaders in educating special populations. The WWW has become an invaluable resource for notifying special population students of services available at their institution. Creating home pages that are accessible to a diverse group of users would insure the universality of the WWW.

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Using Computers in the Classroom to Promote Generative Strategies for Reading Comprehension

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Abstract

Reading management programs have become very popular in elementary schools. Students select a title from a prescribed reading list then are tested for recall of facts and events in the story. Students are motivated to read as many titles as possible since they must achieve a certain score to win prizes. Although there have been reports that this increases voluntary independent reading, programs like Accelerated Reader® do little to increase comprehension or enhance reading instruction. Generative strategies use integration and organizational activities to increase both recall and comprehension of textual information. For this study, students were assigned two different book titles for independent reading. Using thinking maps, the students analyzed the information in the books, then used these to generate test questions for a mock Accelerated Reader test. The results show marginal differences between pre and posttest scores, however there was a significant improvement when students tested each other with their own test items. In addition, students' test items were aligned with the Levels for Thinking model used by the North Carolina Department of Public Instruction for end-of-grade tests for higher level thinking. Half of the student-generated test items matched higher level thinking categories. Students were able to generate multiple choice test items, distractors, and correct answers at a high level of thinking. Three models were used to compare student-generated and criterion reference test items: Generative strategies (Wittrock), Thinking Maps (Hyerle), and Dimensions for Thinking (Marzano).

Introduction

The Accelerated Reader®(AR) program is becoming increasingly popular in elementary, middle schools, and high school reading programs. Currently there are approximately 43,000 schools across the United States (Education Commission of the States, 1999) that use the AR software. Students choose from a list of titles that have been selected for their prescribed reading level then take quizzes to show mastery of content. Although these reading-management programs have contributed to an increase in voluntary reading, there are few reports (Mathis, 1996; Turner, 1993) suggesting that AR programs enhance comprehension or are useful as a tool for reading instruction. Most of the AR quizzes appear to measure recall of factual information only. Generative learning theory supports the use of cognitive strategies to promote improved comprehension in addition to recall of facts. There are a number of activities that could be considered generative. These include developing test questions, writing summaries from a passage of text, elaboration by developing a multimedia presentation, and analysis of content by generating charts and tables (Morrison, Ross, & Kemp, 2001).

Purpose of the Study

Voluntary independent reading may be increased through computerized reading-management programs, but the tests used by these programs are largely designed to measure recall of main ideas, characters, settings, and sequence of events in the story. If the reader does not gain a conceptual understanding of ideas and principles communicated in the books, tests similar to those administered through the reading-management programs, may not reveal deficiencies in comprehension. Research in generative learning theories have provided much evidence to support the use of generative strategies to increase comprehension of ideas and concepts, in addition to recall of facts. Comprehension of textual materials read during sustained voluntary reading sessions may be increased by combining two types of generative strategies.

First there are "organizational" strategies for the analysis and interpretation of textual information. Through the use of organizational charts, students analyze the ideas presented in a reading passage. Sentences, paragraphs, and chapters are distilled into basic ideas and concepts. The product of this analysis is displayed through visual tools such as bubble maps and flowcharts.

Second, there are "integration" strategies that use the integrative approach with student-generated test questions. Using their own thinking maps to interpret reading passages, students could generate test items consistent with higher level thinking processes similar to Dimensions in Thinking and those recommended by the North Carolina State Department of Public Instruction for end of grade tests. Students should be able to connect what they already know about a topic with the new ideas and concepts read in the text. Thus, three questions were generated to further investigate these strategies for teaching reading and writing comprehension; (1) can students generate test items consistent with higher level thinking processes similar to those recommended by NCDPI and Marzano's model for higher level thinking, (2) will the use of organizational strategies for generating original reading comprehension questions significantly affect student performance on a criterion referenced test for main idea, sequence of events, fact versus opinion, and cause/effect factors, and (3) will students perform better on a criterion referenced test than their own student-generated test for reading comprehension?

Review of the Literature

Generative Learning Theory (GLT) first appeared in the literature in the early 1970's (Wittrock, 1974). Since then, reports on the effective use of generative strategies for improving recall and comprehension skills for reading (Dunlap, 1999; Volk & Ritchie, 1999; Wittrock & Alesandrini, 1990; Wittrock, 1991) have continued to be published. GLT is based on brain research which suggests that neural processes for learning are deeper and more lasting when connections are made between prior knowledge and new information. Wittrock (1992) defines generative learning as a process that leads learners to see relationships, (1) across concepts and (2) between prior learning and new information. Evidence that these connections are meaningful can be found students' writings of summaries, metaphors, paraphrases, and outlines. These strategies all fit in one category for generative learning known as integration strategies (Volk & Ritchie, 1999). In a second type of generative strategy, students may use tools for analysis of textual material for the purpose of seeing relationships between ideas, concepts, or events in a reading passage. A variety of tools can be used to accomplish this analytic type of processing. These include students' generated charts, tables, graphs, and concept maps and are known as organizational strategies.

Thinking Maps

The use of visual tools for organizing ideas and concepts found in textual information has been reported as useful for helping students translate what they have read into graphic images. These are in the form of thinking maps. Hyerle (2000) has organized these thinking maps into eight primitive formats, circle map, bubble map, double bubble-map, tree map, brace map, flow map, multi-flow map, and bridge map. Each of the primitives is unique in form and purpose. There are a number of benefits for using the maps. By organizing information into the appropriate map, students are able to increase memory of factual information, gain deeper conceptual understanding, communicate abstract concepts, and enhance creativity for perception-taking.

Dimensions for Thinking

North Carolina has built higher order thinking skills into classroom activities in all content areas for K-12 schools (Houghton, 1994). (*Thinking Skill Levels*.
Available: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/homeNCthink94.html]). These activities were developed along with accountability measures adopted by the state in the form of End-Of-Grade Testing (North Carolina, 1992-1993).
Activities for the classroom were planned around thinking skills levels developed by Robert Marzano (1988, 1992). Marzano's model is a framework for higher level thinking applied to specific strategies for the classroom. It contains eight categories: focusing, information gathering, remembering, organizing, analyzing, generating, integrating, evaluating. NCDPI curriculum specialists reduced these eight categories to seven by collapsing the subcategories for focusing, information gathering, and remembering to one category, "knowledge". Table 1 shows how generative strategies, as defined by Morrison, et al., (2001), compare with Hyerle's Thinking Maps and the NCDPI's adaptation of Marzano's model, Dimensions for Thinking.

Table 1 Generative strategies, Thinking Maps, and Dimensions for Thinking are compared as generative learning models.

Morrison, et al. **Generative Strategies** (based on Wittrock)	David Hyerle **Thinking Maps**	NCDPI adapted from Marzano's **Dimensions for Thinking**	Strategies for Teaching
Recall	Context/frame of reference	Knowledge	>Using drill and practice software, repetitive games with feedback >**Circle map** for brainstorming, defining words List attributes or list the steps in a procedure
Organizational	Describing qualities Compare and contrast Classification Whole/part Sequencing	Organizing Analyzing	>Using productivity software to generate charts, graphs, or tables >**Tree map** for organizing topics >Organize notes from lecture >**Bubble maps** for organizing and identifying key components from information >Classifying groups of items into categories on the basis of attributes.
Elaboration	Cause and effect Analogies	Applying Evaluating	>Using different media forms to generate an expanded version of concept or idea >Using **flow maps** to sequence story parts, analyze and prioritize event and identify cause and effect relationships >Judging the value or logic of ideas

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Integration	Whole/part Analogies Cause and effect	Generating Integrating	>Use word processor or webpage editor to generate summaries, outlines, and analogies >**Bridge maps** for comprehending analogies, similes, and metaphors >New information and prior knowledge are connected, combined and incorporated to generate a cohesive statement with new understanding.

Sample

The sample consisted of twenty 4th grade students from a suburban elementary school. There were 19 Caucasian children and 1 African American child. None of the students were eligible for free or reduced lunch programs, thus it was expected that students came from middle to high SES environments. None of the students had been administered the AR reading test for reading material used in the study, therefore few, if any, of the children had read the books used for the treatment.

Method and Materials

Students were assigned two titles, *The Velveteen Rabbit,* and *The Lion, the Witch, and the Wardrobe.* Each child had his or her own copies purchased with funding from a university/school partnership grant. Students were introduced to the researcher and told they would read the books, then as a special project, would create original Accelerated Reader® tests for other students in the school. They were also told that they should generate thinking maps related to the content of the books. Prior to this study, the students and the classroom teacher had all received instruction in the use of thinking maps for organizing and interpreting information, and were familiar with the eight types of thinking maps as described by Hyerle (2000)

The first treatment

After each child had read *The Velveteen Rabbit,* students were administered a reading comprehension test developed by the researcher and the classroom teacher. After the tests were scored, the teacher prompted students as they brainstormed and generated phrases and key terms for the thinking maps. Inspiration®, a flowcharting software designed for elementary through high school age students, was used to display the maps on a wall screen. Hard copies of the maps were printed and returned to the students. Students were then instructed to use their thinking maps as a guide for writing the questions that could be used for the AR reading tests. These activities were spread over several days. Students were also given skills instruction in how to use the Inspiration® software and how to develop tests using the authoring program, Hyperstudio®. Many of the students were familiar with both software packages and needed less skills training than had been anticipated by researcher. After the test items had been written, students were administered a posttest. Since the *Velveteen Rabbit* was below the recommended reading level for this 4th grade class, (AR suggests grades 1-3 for this title), difference between the pre and posttest was not significant. The purpose in the first treatment was to investigate possible technical problems and to determine the computer skill level of the students. The first treatment was actually a pilot test for treatment number 2.

The second treatment

Students were given an independent reading assignment for *The Lion, the Witch, and the Wardrobe.* Each child had his or her own copy of the book and was given the freedom to read the book independently at home, or in their school classroom. After a period of two weeks, all the children had completed the book and were given a pretest created by the researcher. Items for this test were categorized by (1) Main Idea, (2) Sequence of Events, (3) Fact vs. Opinion, and (4) Cause and Effect. Items were developed to measure higher levels of comprehension and were aligned with the North Carolina Department of Public Instruction's Model for Thinking Skill Levels (NCDPI,
Available online: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/NCmarzanoThink.html]). The Thinking Skills Levels model is also used to develop End of Grade (EOG) tests that determine promotion or retention for grades 4 and 8. In addition to aligning test items with Thinking Skill Levels, the test was reviewed by the classroom teacher. The researcher was confident in her ability to evaluate the test as reliable for measuring reading comprehension. There were two reasons for this; first, she had worked as a trainer in the area of student assessment, and second, she was the designated coordinator for professional development in her building. Items have been aligned with higher level thinking processes according to Marzano's Model for Dimensions of Thinking in Appendix I.

After the pre test was completed and scored, students were assigned thinking maps to analyze the content of the book. Students used bubble maps and flowcharts to present the visual images for concepts related to book characters, factors for cause and effect, and sequence of events. The maps were generated in two formats; first, the researcher developed the maps using Inspiration® as the students dictated related concepts and ideas for the maps, and second as an independent activity using paper and pencil.

After maps were completed, students were given the assignment to "write the test questions" for the AR test program. This was an independent activity in which students wrote the questions at their desk using paper and pencil. They were told that this would be their official "AR test" and could be used by others in the school to test their reading comprehension of *The Lion, the Witch, and the Wardrobe*. Students were also instructed to use information generated in the thinking maps to write their test questions. Each student wrote 5 to 7 test questions for the final "Accelerated Reader" test that would be generated using the Hyperstudio® software in the school's computer lab.

Following this, over a three-week period, students were divided into small groups and taken to the school computer lab. The researcher and the classroom teacher monitored students as they entered questions into the Hyperstudio "reading test". The test was a template prepared by the researcher and saved to disks for each student to use independently. Students were encouraged to enter as many questions as time permitted and to create elaborated versions of their test with reward buttons linked to "correct answers". Time limitations allowed only two visits to the computer lab, thus, the average number of test items completed by each student was four questions.

Following the computer lab sessions, a posttest was administered and scored by the researcher. The items in the posttest were identical to those in the pre test for measuring reading comprehension of (1) Main idea, (2) Sequence of Events, (3) Fact vs. Opinion, and (4) Cause and Effect.

Analysis of Data

The content of student questions (See Appendix II) was categorized by levels of thinking defined by NCDPI model for *Dimension for Thinking*, which is also used as a framework for test items written for EOG Tests. Each item was matched to one of the following: knowledge, organizing, analyzing, applying, evaluating, generating, or integrating. These categories represent thinking processes that would be required by the test taker as well as the test giver. It is assumed that students who generated the test item for a multiple choice test, must first write the test question, then be able to identify the correct answer as well as generate several distracter responses. Thus, students would engage in generative strategies for developing test questions, and at much higher levels than simple recall of facts.

The posttests were scored by number of correct responses. SPSS was used to calculate differences in means for pre and posttests. T test for paired samples was used to determine significant differences between the pretest and posttests generated by the researcher and posttests generated by students.

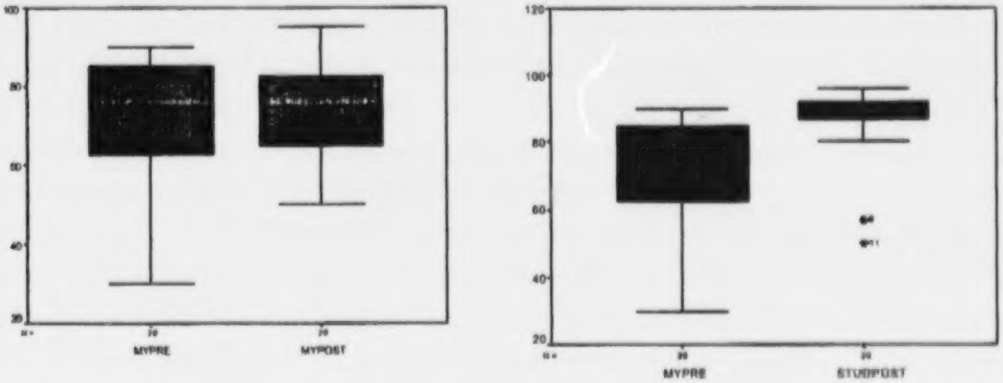
Results and Discussion

Test items developed by the researcher were aligned with the NCDPI recommendations for test development for higher levels of reading comprehension. As can be seen in Appendix II, most of the items could be categorized as organizational. Generative strategies for organization help students analyze information, see relationships, compare and contrast concepts, and restructure a large amount of information into appropriate categories. Compared to the researcher's posttest, student-generated items for the posttest contained more recall type questions but also included items for analysis, organization, application, evaluation, and integration.

Differences in pre and post test scores

There was some variation in the spread of the scores for the researcher's pre and posttest. There was very little variation in the scores for the student-generated posttest scores. As can be seen in the box charts in Figure 1, test scores on the student-generated test were tightly clustered around the mean value 85. Scores were more varied in the pre test (m = 71.5, sd = 16.7) than in the post test (m = 84.7, sd = 13.5)

Figure 1 Box charts showing spread of scores around the means for pretest and both posttests.



		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MYPRE	71.50	20	16.70	3.73
	MYPOST	75.75	20	11.634	2.60

		Mean	N	Std. Deviation	Std. Error Mean
Pair 2	MYPRE	71.50	20	16.70	3.73
	STUDPOST	84.75	20	13.580	3.03

Since pre and posttests were administered to the same sample of students, there should be a strong positive correlation between test scores on the pre test with the scores on the researcher's posttest as well as a strong positive correlation between the pre test and the student-generated posttest. The paired sample statistics (See Table 2) revealed a significant correlation ($p < .05$) between the pre test and post tests ($r = .76$, $df = 19$; $r = .77$, $df = 19$).

Table 2 Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	MYPRE& MYPOST	20	.761	.000
Pair 2	MYPRE& STUDPOST	20	.773	.000

As can be seen in Table 3, the t of 1.74 for differences in the researcher's pre and posttest was not significant at the .05 level, however, there was a significant difference in means between the pre test and the student-generated post test ($t = 5.57$, $df=19$, $p < .000$).

Table 3 Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	MYPRE - MYPOST	-4.25	10.88	2.43	-9.34	.844	-1.74	19	.097
Pair 2	MYPRE - STUDPOST	-13.25	10.62	2.37	-18.22	-8.27	**-5.57***	19	.000

Conclusions

Close to half the student-generated test items were written to measure recall of basic facts. These test items would be aligned with the students' thinking processes for recall of who, what, when, and where did this happen in the story, however, over half the students' tests questions were written at a higher level than simple recall of facts. Since students developed the items independently, this study provides strong evidence to suggest that elementary children are able to use thinking maps or other visual tools with generative writing strategies for deeper processing of textual information. From their own analyses, students were able to generate test questions that could be used to measure the higher level thinking processes of their peers. In addition, students were able to evaluate the accuracy of correct responses and determine the suitability of distracters for a reading comprehension test. It cannot be determined from this study, the full effect of the thinking maps as visual tools for interpreting and analyzing textual information. Further study is planned to investigate differences in the quality of generated test items with and without the use of the thinking maps. In addition, there should be an investigation of the effect of computerized software for generating maps when compared to simple maps produced by paper and pencil. Volk and Ritchie (1999) found significant effects from the interaction of groups with the use of generative strategies using manipulatives. Students for this study worked in a whole group session facilitated by the teacher and the researcher to generate thinking maps. Their questions, however, were generated independently using the completed thinking maps as a blueprint to construct the items. Further study in students' use of generative strategies to write test questions, with or without electronic thinking maps, may reveal similar interaction effects on their performance on the posttest.

The bubble format was the thinking map of choice for the students. Hyerle (2000) defines the bubble map as an analytic tool. This type of thinking and mental processing should help the student to develop a deeper conceptual understanding of a reading passage. For example, students used the bubble map to analyze the personalities of all the characters in *The Lion, the Witch, and the Wardrobe*. Each character's personal traits were defined, discussed, and then identified as villain, hero, good, evil, protagonist, etc. For some of the maps, students developed a flowchart to analyze the sequence of events. During the whole class sessions, students carefully analyzed the order of events for the story. From this kind of mental processing, it would be expected that students would write more test items for organizing and analyzing ideas. It is surprising, then, to discover that the students' test items were in the categories for *applying, evaluating* and *integrating* ideas. For example, one student wrote, "9. Why did Mr. Tumnus get made into stone?". Since the story did not clearly explain the full reason, the reader would need to make certain assumptions based on the character's actions in relation to the villain's personality traits. In addition, the reader would need to evaluate certain moral justifications that were not explicitly stated in the story. This would, more likely, require thinking processes for integration of new information with prior experiences and synthesis of ideas than organization and sequence of events.

Writing test questions with accurate answers and appropriate distracters would also help students evaluate the concepts and events in the story. Since the test items were generated independently, it may have resulted in students' greater use of generative strategies for integration of new ideas with prior knowledge and across the various ideas rather than organization of events. Integration strategies increase students' ability to see relationships and connections between ideas and concepts. This type of mental processing would certainly result in students' ability to develop questions for application of concepts and synthesis of themes and ideas across the entire book. In answer to the first question in this study, a qualitative evaluation of students' test questions would suggest elementary age children can generate test items consistent with higher level thinking processes.

A paired sample t test was used to measure the differences in means between the pretest and posttest developed by the researcher. It was hoped that the use of the generative strategies would have a more significant effect on students' test scores, however, differences were marginal at the .05 level ($t = 1.74$, $df = 19$, $p < .09$). In retrospect, I would set the significance level at .10 for two reasons. First, this study was not in a controlled laboratory setting nor were students tested for reading ability and cognitive capacity prior to the treatment. Similar to the study by Volk and Ritchie (1999), this was a pilot study with many variables that might interfere with the results of students' performance. Second, scores from matched pairs are less likely to reveal differences based on the effect of the treatment. According to Popham and Sirotnik (1992), with corresponding scores, there is a tendency, that differences in means are less likely to be significantly different.

There was a significant difference between the means from the pre test and means from the student-generated post test ($t = 5.57$, $df = 19$, $p < .000$). Using paper and pencil, each student had written 4 to 5 items, and then entered these into the Hyperstudio® stack for the mock AR test. From this pool of test questions, 20 items were selected. These were copied and pasted into a word-processed document and administered to the students as a paper and pencil test. Conditions for the student-generated posttest were identical to those of the researcher's posttest. T test statistics for paired samples showed a significant correlation between the data from the pre test and the data from the posttests. Students who performed poorly on the pre test, performed at a corresponding level on both posttests, thus it is likely that the student-generated posttest was reliable. In answer to question 2, this would suggest that the use of organizational strategies for generating original reading comprehension questions does have a positive effect for student performance. Further, the effect of the treatment appears to improve scores for a criterion referenced test for main idea, sequence of events, fact versus opinion, and cause/effect factors. There should be further study to provide evidence to support the effectiveness for the use of generative test questions. This could be accomplished by measuring gains in scores for this sample with a comparable group who did not receive the treatment. The answer to question 3 is answered by comparing the means between both posttests. Descriptive statistics show that students did perform better when answering their peers' questions than the items from the researcher's test (see Table 3). At first, this may appear of little interest, but with the qualitative evaluation of students' test items for higher thinking processes, their performance on this test may reveal some positive effects from the treatment.

Students were also highly motivated to develop a test that would be taken by their peers. This was an authentic problem in which students were challenged to write a mock test for Accelerated Reader. Since research has shown that students are motivated to solve a real-world problem, I was able to observe students as they exhibited an effort to construct questions which they judged as fair and would be important for measuring reading comprehension. Because of the earlier experiences with AR testing, students were familiar with the multiple-choice format. Based on this experience, they were also able to make some judgments in what kinds of questions measure reading ability.

The pool of questions written by the students was characteristic of high level of thinking processes for seeing relationships among ideas presented in the story. Students also demonstrated a high level of evaluative skill for constructing test questions that are suitable for measuring reading comprehension. Although student performance showed marginal performance on the criterion-referenced posttest, students showed significant improvement when answering test questions developed by their peers. This study clearly provides support for the use of generative strategies for higher level thinking when reading and interpreting textual information.

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Appendix I	Pretest developed using framework from Dimensions for Thinking. Available online: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/NCmarzanoThink.html]
NCDPI adapted from Marzano's Dimensions for Thinking	**Pre and Post Test Questions** Generated by Researcher
Knowledge Declarative and procedural knowledge	**Recall** 11. Who did Lucy meet first? 13. What do the children do after Aslan comes back to life?
Organizing Comparing, classifying, and ordering sequences Analyzing Identifying attributes and components; Identifying relationships and patterns	**Sequence** 9. What happened first? a. Peter discovered..... b. Lucy found.... c. Edmund found... d. Edmund and Lucy found.... 10. Aslan was victorious .... a. after Edmund... b. after Aslan was... c. after Peter was.... d. after all the animals.... 12. Who were the last two people to see Aslan alive? **Cause and Effect** 14. Edmund loved the idea of becoming a Prince because..... 15. The Professor told Susan and Peter that Lucy might be telling the truth because.... 16. The Battle between Aslan and the Witch would have been lost except..... 8. Lucy was very worried about Mr. Tumnus because..... **Main Idea** 1. Which of the following best describes Aslan? 2. Which of the following best describes the Witch? 3. Which of the following best describes Edmond?
Applying Demonstration of prior knowledge within a new situation Evaluating Confirming or proving the truth of an idea,	**Main Idea** 4. At the beginning of the story, Edmund pretended that he had not really found Narnia and was making the story up because...? 7. After Edmund had been rescued by Aslan he felt..... **Fact versus Opinion** 17. The Witch was wicked and lonely 18. Aslan was good and brave 19. In the end, Edmund was a hero 20. Turkish Delight is delicious
Generating Inferring, Predicting & Elaborating Integrating Summarizing and restructuring; identifying important components to generate a cohesive thought.	**Main Idea** 5. Why did Edmund have to die at the hand of the Witch? 6. Why did Aslan die? 7. After Edmund had been rescued by Aslan he felt.....

Appendix II	Comparison of researcher-test with student-test for match with higher levels of thinking.	Note: certain test items may match more than one category.		
NCDPI adapted from Marzano's Dimensions for Thinking	**Post Test Questions Generated by 4th Grade Students**	**Dimensions for Thinking category**	**Number of items from researcher's test that match category (see Table 2)**	**Number of items from students' test that match category**
Knowledge	1. How did Lucy discover Narnia? 2. Who was Aslan? 5. The White Witch told Edmund he would become a _______when she was gone…. 10. What did Father Christmas give Peter? 16. What game were the kids playing when they found the wardrobe? 18. Where did the Professor live? 19. What food did Mr. Tumnus NOT give Lucy in his home? 21. How many reindeer did the White Witch have on her sled?	Knowledge	2	8
Organizing Analyzing	3. When Lucy and Susan followed Aslan, they followed him to….. 6. The first kid who knew about Narnia was…. a. the youngest in the family b. the last to know about Narnia c. the meanest kid in the family d. the oldest kid in the family 8. When Lucy went to Narnia, who did she first meet? 15. Did Edmund get to eat his favorite food when he got to the Witch's house?	Organizing Analyzing	19	4
Applying Evaluating	7. Why did Aslan die? 9. Why did Mr. Tumnus get made into stone? 11. Why did Mr. Tumnus ask Lucy if she was a daughter of Eve? 12. Why does Edmund leave the Beaver's house? 13. What does Edmund want from the White Witch? 26. Why did the Beavers say, "Be quiet!"?	Applying Evaluating	6	6
• Generating • Integrating	14. Why didn't Edmund tell the others he had found Narnia just like Lucy did? 17. How was Aslan brought back to life?	Generating Integrating	3	2

The Technology Teaching Lab: Meeting the ISTE Standards

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Abstract

The technology teaching lab program is a series of 2-hour labs that runs concurrently with preservice methods blocks. The purpose of the lab is to give the students the experiences necessary to integrate technology into their classroom. The lab provides the students with instruction, opportunities, and equipment to take their technology-enhanced lessons directly to the field.

This research found that given time, technology, assistance, and experience, students could create technology-enhanced lessons. The implementation of the technology teaching lab, connected with the profile template, provides preservice teachers with the structure and opportunities to meet the profile goals set by ISTE. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

Problem

According to the U.S. Department of Education, only 20% of the 2.5 million teachers currently working in our public schools feel comfortable using the technologies available to them (NCES, 1999). This is a tragedy, but one that is remedied by providing students with a true working knowledge of current educational technologies and opportunities and experiences to integrate those technologies into their classrooms. Many colleges of education have found ways to increase students' knowledge of technology through independent courses. It is reported by the Office of Technology Assessment (1995) that much of technology instruction is related to the teaching of technology instead of teaching with technology to enrich curriculum (Duhaney, 2001). Nevertheless, institutions should teach teachers how to use technology to support multiple content curriculums (Ingram, 1994). Unfortunately, there has been little done in the area of experiences of technologies in the classrooms. Because of the importance of experiences with technology in the field, it is the goal of many departments of education to include clinical experiences (Duffield, 1997).

Currently, the education department at Ohio State University at Mansfield is trying to incorporate technology into our courses by giving assignments that encourage the use of technology. Unfortunately, there is no time given to students to experiment or develop the technology-enhanced lessons. The methods courses are full of methods content. Nevertheless, it is vital to give students experiences both in teaching with technology and participating as a student using technology (Cuba, 1995). Because of this, our department makes every attempt to enhance our teaching with technology. This happens through required presentations, including the input of digital images, expectations of technology for required lesson development and assessments, the use of digital picture displays to enhance an activity, and the use of Web CT. Through the development of these and other uses of technology in our methods courses, we are beginning to give our students experiences from a student perspective. In addition to this, though, there must be a teaching component to technology experiences. This happens with the development of the technology teaching lab.

Research Questions

This is a qualitative ethnographic study in case format as defined by Guba and Lincoln (1994). It is because of this methodology that issues of description and interpretation are of utmost concern. The questions informing the interpretation of data in this study have the following foci:

- Determine whether a student can or cannot reach the expectations of the ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab.
- Determine types of technology infusion used to meet these standards.
- Determine the perceived ability of the students following the technology teaching lab.

The Technology Teaching Lab

Before the Technology Teaching Lab, if a student wished to use technology in her field placement Ohio State University at Mansfield, not only did she have to plan, create, and write the lesson in her own time in addition to the other lessons from the content areas, but she had to depend on the technologies of the school in which she is placed. Often times, the schools would have little equipment or equipment that is not compatible with the developed lesson.

The Lab Course

The goal for this program is to increase the use of technology in our students' lessons in ways that will enhance their teaching. The purpose of this lab is to provide the preservice teachers in our elementary education program opportunities and assistance in creating and using technology-enhanced lessons into their field placements. The Technology Teaching Lab component is a 2-credit course scheduled for two quarters to run simultaneously with our methods blocks. Connections and constructivist theory are two foundations to our program. Any new addition to our program needed to address both core areas. Because of our strong commitment to the integrated approach to teaching, our technology component needed to connect to our methods blocks. Our methods blocks run in two consecutive quarters to include a methods course from social studies, math, language arts, and science. We addressed the issue of connection by including requirements for technology-enhanced lessons in each of our syllabi. Within each content area, there are expectations for lesson development and integration within those lessons. We expect our students to write their lessons in a unit: integrating content as much as possible, when there is a natural fit. By connecting the technology teaching lab with the content methods courses, we provide our students with multiple ways to integrate technology into each content area and thus integrate the content areas through technology. Each methods course has an expectation of technology integration into the lessons.

The lab course meets once every week during the same quarters as our methods block for a two-hour period. There are two time slots available to better meet the needs of the students: one after school on class days and one after school on their field placement days. In addition, the lab space is available for walk-ins throughout the week. The students work during this time to create technology-enhanced lessons that they will take directly to their field placement. There is little direct instruction; instead, time is spent on the uses of instructional technologies, demonstrations of those uses, and play with the equipment. The primary structure of the lab course is open and one of discovery and experience. Students are to play and create lessons, again, to take directly to the field.

Students write technology-enhanced lessons and use educational technology in their field placements. This important facet (that of experience) of the lab course gives students the practice in developing and revising educationally sound, technology-enhanced lessons for their future classrooms. The lab provides students supervised time to experiment with the hardware and software to create technology-enhanced lessons that connect to the requirements of the methods courses. These technology-enhanced lessons incorporate imaging, Internet use, and presentation tools. Then, the students take the created lessons directly to the field.

The Lab Instructor

We addressed our other area of focus, constructivist-learning philosophies, through the format of the lab course. The natural starting point for instruction in a constructivist classroom is not the material to be taught, but student interests, prior experiences, and current understandings (Ravitz, Becker, & Wong, 2000). Because of this, a true constructivist form of a Technology Teaching Lab would have to accommodate for a variety of levels of technology abilities in the students and provide for their varying interests. We designed the Technology Teaching Lab course to be one of discovery and experience. The purpose of the lab is to provide our students with the opportunities to develop appropriate uses of the technologies in their field placements and to then take those lessons directly to the field, giving the students the experiences necessary to integrate technology into their classroom.

The teacher's role in a constructivist setting is to facilitate student-designed efforts. This instructor is also available in the physical space of the lab to assist students. The major focus of the instructor's time is on play and on emergent needs of particular lesson creations. The instructor's responsibility is to help the students develop educationally sound applications of technology in their field placement in close connection to the education department and the needs and requirements of the methods courses. The instructor is also available in the physical space of the lab to assist students.

Equipment

We purchased a variety of technology tools that tour students could take directly to their field placements. These tools included: portable laptop and projector sets, flex cams, digital microscopes, computer calculator sets, a variety of canned software, digital cameras, and digital video cameras. By providing the students with the equipment, the students can create a lesson and deliver the lesson directly without concern for lack of hardware, software, or hardware mismatches.

The Assessment tool

As a department, we have adopted the ISTE standards (International Society for Technology in Education, 2000) for technology in preservice education. As an evaluation piece, I created a template out of those competencies specifically set to the professional preparation performance profile created for pre-service teachers to be completed before their internship experience (ISTE, 2000). Each of our students downloaded this template, the profile in table form, onto a zip disc. Our students wrote a short narrative addressing how they hit each of the competencies and included with this narrative a hyperlink to electronic evidence of their work. This evidence could be in a variety of forms. For example, if a student wanted to demonstrate that she wrote and taught a lesson using Hyper Studio, she might use two forms of evidence. First, she might hyperlink the lesson portion to her actual text document write-up of the lesson. Second, she might hyperlink her teaching evidence to an example of a student's presentation. In doing this, the student has demonstrated her capabilities to write and teach a technologically enhanced lesson, and demonstrated her ability to use technology as a form of self-evaluation. She is documenting her technology use and at a future time, can reflect on that use and revise and recreate. Another example might be that of email threaded discussions maintained throughout a field assignment. The student teacher could simply retain a copy of the discussions and hyperlink them to the template to use as electronic documentation. A sample portion of template is provided in table 1.

Table 1. Template Sample

Prior to the culminating student teaching or internship experience		
Technology Operations and Concepts		
	Task	**Electronic Evidence**
Examine technology tools used to collect, analyze, interpret, represent, and communicate student performance data.	"Free online grade book software."	http://www.classbuilder.com
Planning and Designing Learning Environments and Experiences		
Identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction.	"Taught an integrated lesson which included an Excel graphing exercise in the computer lab. Twenty-three students in class."	bellvillelesson17.doc
Design and teach technology-enriched learning activities that connect content standards with student technology standards and meet the divers needs of students.	"An example of a student-produced graph from an integrated technology lesson I taught in the computer lab at Bellville Elementary."	**Cody.xls**
Teaching, Learning, and the Curriculum		
Apply on-line and other technology resources to support problem solving and related decision making for maximum student learning.	"Incorporate higher-level thinking problems and questions with NCTM math-related activities."	http://standards.nctm.org/document/eexamples/index.htm
Productivity and Professional Practice		
Identify and engage in technology-based opportunities for professional education and lifelong learning, including the use of distance learning.	"Opportunities for professional development and resources."	http://www.nctm.org http://www.ohioschoolnet.k12.oh.us/
Social, Ethical, Legal, and Human Issues		
Identify issues related to equitable access to technology in school, community, and home environments.	"Equity project WI '01"	**EquityWI01.ppt**

Methodology

Purpose of Study

The purpose of this study is multifaceted: first, to determine whether or not students can meet the expectations of the professional preparation standards set by the ISTE standards can be met by the implementation of the technology teaching lab and second, to determine what level of technology infusion students choose to use in meeting these standards and finally to guide development of the technology teaching lab. The results of this study will be beneficial to other departments of education in their drive to meet national standards and infuse technology into their programs.

Design, Instrumentation, and Data Analysis

The design of this study utilized qualitative research methods from the interpretivist paradigm (Guba & Lincoln, 1994). This is a case-study to represent a molar unit, a multiple of individuals (preservice teachers). The use of a molar unit in this case is to extend external validity of results (Huberman & Miles, 1994). The case format is not one of generlizability; it instead has a focus of transferability. This transfer is to similar sets of participants. Data were gathered from multiple sources during the 2000-2001 school year.

The data was collected in two formats. First, the ISTE profile template (as defined previously as the tool for the course). The data from the template was inserted into a database for ease of analysis. The database was analyzed in a variety of manners. First, the database was used to determine what the students used as an electronic example for their meeting a particular standard. Second, the variety of evidence used to document to student's meeting the standards. Finally, the database was used to interpret the level of technology infusion.

In addition to the database, a survey was distributed at the end of the second quarter in which the students took the lab. This survey asked questions about the student's perceptions of their technology abilities, their anticipated use of technology in the classroom, and their impressions of the technology teaching lab. Open-ended comments listing strengths and concerns were coded by emergent topics. A cluster method of data analysis was used throughout the interpretation of data (Huberman & Miles, 1994).

Description of site and participants

This study took place at a regional campus of a large, mid-west University. The participants for this study were 21 Masters of Education students. Their ages ranged from 23-43, four male; 17 female, 20 Caucasian; 1 Asian-American, and from middle-class background. Students came to the masters degree certification program with a variety of undergraduate degrees: elementary education, psychology, law, the ministry, and private business. All students were required to take the 2-credit hour technology teaching lab course with each of their methods block quarters (totaling 4 credit hours). This was the first year of this requirement.

Results

Demonstration of Technology Use

At the end of the second lab course, students completed their templates with a narrative stating how they met each standard and a hyperlink connecting to a piece of electronic evidence that supported their statement. Table 2 shows the distribution of electronic evidence used by the students in their templates. The data is heavy in the areas of web sites and presentations. The use of web sites was intriguing and warranted further investigation into the manner by which they used the sites as documentation of meeting a particular standard. The manner in which the sites were used in denoted in the second category of results, level of evidence. The use of presentations as a demonstration of evidence stems from the assignments given in the methods block courses. In the 2002-2001 school year, the year of this study, the students were required to produce a presentation in the math and science methods block courses in which they took digital video of an integrated lesson, imported portions of their video into a power point presentation, and reflected upon the concerns and strengths of the lesson. This project was called the MST project and each student created two presentations in this format; one in the first methods block and another in the second methods block.

Table 2. Evidence Used

	Web Sites	Documents	Excel	Presentations	Other
Technology Operations and Concepts	19	1	1	1	18
Planning and Designing Learning Environments and Experiences	40	22	2	71	3
Teaching, Learning, and the Curriculum	48	11		1	
Assessment and Evaluation	48			20	10
Productivity and Professional Practice	20	4	2	14	
Social, Ethical, Legal, and Human Issues	92			2	2
Total	**267**	**38**	**5**	**109**	**33**
Percentage of profile standards met	**59%**	**9%**	**1%**	**24%**	**7%**

Level of Technology Evidence

In addition to the types of technology used by the students as evidence of meeting the profile, the data was analyzed for level of technology integration. In this analysis, a clustering and coding method was implemented. This coding produced three major categories of technology infusing: teacher-centered technology, child-centered technology, and task-centered technology. Teacher-centered technology refers to technology used by the teacher but in the context of a lesson. In this case, the teacher is the worker. It would be similar to the teacher using technology to enhance a lesson that would otherwise be teacher directed. An example of teacher-centered technology would be a teacher-created presentation using power point or Hyperstudio to demonstrate the development of a seed. Another example of teacher-center technology would be a class-created excel chart in which the teacher input the data on a centered machine that is connected to a projector or large screen television. Another example of a teacher-center use would be the teacher using some sort of project device to demonstrate the components of a seed using a flex cam. Still another example of a teacher-center infusion would be a class game using a canned CD and a projection device.

The second category for technology infusion determined by analyzing the data from the templates is child-centered technology. This format refers to technology used by the children in the class, either in small groups or individually. In this case, the child is the worker. This would be similar to the teacher using technology to enhance a small group task or individual seat work assignment. An example of child-centered technology would be child creating a publishing document that focused on a particular country to be used as an assessment in a class. Another example of this format would be a group of students creating a presentation documenting the recycling of garbage. Another form of child-centered technology would be a student writing a story and importing still photos to illustrate the story. Still another form of child-centered technology would be the use of Internet interactive tools with each child at a computer station (ex. E-examples from NCTM).

The third category for technology infusion determined by the template is task-center technology. This format refers to technology used by the teacher in the design of a lesson, a class, or profession growth or organization. In this case, the task is the focus with the teacher as the worker. This would be aligned to traditional preparation and paperwork connected to the profession of teaching. An example of task-centered technology would be a web site used to obtain information about a lesson on the circulatory system. Another example would be the creation of an excel chart or word "chat" or email format that demonstrated collaboration on issues of teaching. Still another example would the completion of an assignment for a course in education (in document, sheet, or presentation format).

Table 3 indicates the various forms of technology evidence used by the preservice teachers to demonstrate competence in the performance indicators. Special note is made to the performance indicator goal, which in many cases does not require lesson development, but rather technology use in the profession of teaching.

Table 3. Narrative Coding

	Teacher-center technology	**Child-centered technology**	**Task-centered technology**
Technology Operations and Concepts	0	0	54 (100%)
Planning and Designing Learning Environments and Experiences	12 (7%)	67 (38%)	96 (55%)
Teaching, Learning, and the Curriculum	0	4 (6%)	60 (94%)
Assessment and Evaluation	1 (1%)	12 (12%)	87 (87%)
Productivity and Professional Practice	0	0	43 (100%)
Social, Ethical, Legal, and Human Issues	0	0	104 (100%)
Total	**13**	**83**	**444**
Percentage of profile	**3%**	**15%**	**82%**

Student Perceptions

Secondary to the template, was the survey. This survey was administered for the purposes of course development. Nevertheless, the survey indicates a level of ability and comfort that could inform other institutions where technology infusion programs are being developed and under consideration. Table 4 indicates the technologies that student would most likely use in their teaching. This reflects technologies that were emphasized during the technology teaching lab and those technologies that were demonstrated during the technology teaching lab.

Table 4. Technology most-likely to use in teaching

Hardware	Raw score*	**Rank**	Raw score*	Software
Digital camera	26	1	22	Word processing
Flatbed scanner	57	2	43	Internet
Digital video camera	64	3	75	Power point
Flex cam	71	4	83	Hyperstudio
Multimedia projector	94	5	93	Educational programs
Dissecting microscope	100	6	104	Spreadsheet
Digital balance	113	7	111	Database

* Combined rating of 20 students with a rating of 1 as most likely.

Student Perceptions of Technology Teaching Lab

An open-ended comment section of the survey revealed what the students thought were concerns and strengths of the technology teaching lab. These concerns could be categorized into three subheadings: Instructor, time, technology, and ability. Interestingly, the instructor and ability were indicated and coded as major categories for both the concerns and the strengths of the technology teaching lab. The instructor was commended on several surveys for being available, experienced, and flexible. An example of this was, "Instructor was flexible, helpful, patient, personable, kept the class 'real'". Alternatively, the instructor was also listed as a concern for a lack of expertness, and not conducting the class on an individual level. Ability was an indicator of strength; "Class is needed, gained an enormous amount, a lot further in my ability to use technology, I learned a lot, I feel capable," and a concern; "…overkill, quite comfortable previous to this class, lab times inconvenient, class needs to be 'stepped up', should have been much more help, start classes in fall, need better connection to methods courses."

One of the categories that did not show through in both strengths and concerns was that of time. Time was indicated as a strength because students felt that they were given an extended period of time to actually write technology-enhanced lessons; "...lots of time to work on our technology components of projects, more time to use technology to plan lessons." Technology was listed as a concern, as it often is in the cases of infusing technology into the classroom; "…technology fail (ures), better connection to printer, (need) better equipment"

Discussion

The technology teaching lab, while still in its infancy, shows great promise. It provided a venue for preservice teachers to address issues of technology connected to their field placements and to their classroom assignments. It demonstrated a connection to the questions stated earlier in this writing.

The Technology Teaching Lab and the ISTE Standards

It follows that students can meet the profile set by ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab and courses similar in focus. The students used a variety of electronic evidence but the primary tool was that of web sites. At first glance, this might be disturbing. However, this indicates that students find the tool of the computer useful in the research and information gathering aspect of teaching and learning. When reading the data, it was necessary to realize that the ISTE profile contains six categories: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. The majority of the six categories focus on technology issues and not technology as a tool of instruction. Under the heading of Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, and Assessment and Evaluation, it would be reasonable to find students using a variety of electronic evidence indicators. It may be advantageous for instructors to suggest types of evidence that would meet particular goals, but I hesitate to say this in light of the focus of constructive methods for the class. By suggesting a specific piece of evidence, it may limit the preservice teacher's creative role in this venture. Still, a wider variety of evidential components would be preferable.

Technology Infusion: Types and Level

By categorizing the evidential narratives given by the students, it was clear that there are three major roles of technology in preservice teacher education: teach-center technology, child-centered technology, and task-center technology. Again, looking at the profile stated, the issues that students needed to address were various. Many students met professional profile expectations using appropriate manners. The students who used child-center technology used it under headings were that was appropriate: Planning and Designing Learning Environments and Experiences and Assessment and Evaluation. Again, at first glance, one might wish to see more teacher-centered and child-center technologies indicated in the narrative section of the template. However, the fact that the students used a variety of teacher, child, and task centered activities is encouraging. It is vital to use a variety of methods of technology infusion into teaching. Just as it is vital to use a variety of teaching methods in teaching. The fact that the preservice teachers used many task-centered narratives indicates the place they are in their program (using technology to complete assignment tasks) and their developmental stage in teaching (initial play and discovery).

Student Perceptions

It is reasonable for the students to wish to use technologies in their teaching that they have familiarity with and that they have had success with in the past. This is clear in their indication that word processing, digital cameras, and presentations would be of interest to them in their teaching. The students in this program were expected to use these technologies throughout the methods blocks and chose to use them in their field placements. They are very familiar with presentation software through class assignment in their methods blocks. It is a goal to get them to feel more comfortable with the uses of other technologies: flex cams, computer calculators, digital imaging, and projection devises. This will happen through the emphasis of these technologies in their methods blocks to give them the student perspective. This experience then will give students a feeling of comfort and success that they can then transfer to their teaching. It is also vital for preservice teachers to see how professors use technology to enhance their teaching. Through this, the process of teaching with technology is modeled and can then be applied to their teaching.

Modifications for the Technology Teaching Lab

There are a few considerations to make to modify the technology teaching lab to better meet the needs of students and the expectations of the ISTE standards. One issue that arose through the data was that of instructor. While the original intend of the technology teaching lab was to create a block of time where students could play and invent, the instructor relied on a more instruction-based format. This created problems for students who felt that they did not need the instructional time on particular technologies and for the students whom desperately need the "play" time to accommodate their learning style. The instructor has since modified his instructional method to better meet the constructivist, discovery format and preliminary lesson submissions from the current cohort of students shows an increase in technology infused lessons. This demonstrates a need for a particular teacher and learner paradigm distinction to best accommodate the technology teaching lab and its intent to foster technology-infused lesson development in preservice teachers' lessons.

Another aspect of modification is that of classroom experience. Our students are benefiting from an increased role of technology in their methods block course. This increase gives the students opportunities to see technology used in instruction from a students' perspective. Some of the additional and continuing aspects of technology infusing in the methods courses include: Computer Poster Sessions, Computer Calculators, Flex Cam and GPS demonstrations, electronic backyard History Projects, Integrated Assignments including the MST Projects (Math/Science), Equity Project (Math/Social Studies), and Drama Display (Math/Language Arts).

Finally, the modification connected to the particular technologies used in the methods blocks and in the technology teaching lab need to be consistently revisited. Technologies available to teachers in the schools are ever-changing and need continual modifications.

Consideration for future research

Currently, students in the preservice program are required to take an inventory of abilities and experiences connected with the ISTE profile. Students take a 2-part survey in which they self-report experiences with technologies and ability with technologies connected to the profile subsections: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. This survey will demonstrate growth incurred by the implementation of the technology teaching lab. Additional data is also being collected for future research connected with the students' lesson plans. Future research will not only use data from the template and the survey, but also coding from the submitted lessons and lesson reflections that include technology as a component.

It would be a benefit to this research and to research on technology in teacher education in general if follow-up studies were conducted to connect preservice teachers' indications of use with actual use, observed and reported after the teachers are employed full-time. Such research would add to the field of technology infusion in teacher education.

Conclusion

In conclusion, this report finds that given time, technology, assistance, and experience, students can and will create technology-enhanced lessons. These experiences of creating and field-testing lessons with the assistance of technology or with the inclusion of technology will aid students in the task of meeting the ISTE professional preparation performance profile. The technology teaching lab is one option for providing such qualities to a preservice education program. In addition, the template used throughout this program is a valuable tool for departments to use when evaluating program and providing evidence for current and future grants. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

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Effects of Embedded Relevance Enhancement in CBIM Program for English as a Foreign Language Learners

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Abstract

This 2 X 2 factorial experimental study is to investigate effects of intrinsic motivation and embedded instructional strategies designed to enhance relevance on students' perceptions of motivation and understanding of the instructional material within a computer-based interactive multimedia lesson for college English as a foreign language students. The findings indicated that highly intrinsically motivated students learned more and the use of embedded relevance strategies facilitates students' language learning regardless of learners' level of intrinsic motivation.

Introduction

Traditionally, schools rely heavily on extrinsically motivated behavior (Brown, 1994). For example, standardized tests, exams which have given high authority, are often used to drive student performance. In most countries that teach English as a foreign language, school-level instruction does not emphasize the function of English as a tool for communication but instead focuses on how to pass the tests. The consequence of this is that students work hard to try to pass the exam to please teachers and parents rather than develop an internal thirst for knowledge and experience. It is not a surprise that students often lose their interest in English learning as a result. EFL teachers should provide students with authentic, functional, interactive, and constructive language learning environments to reduce students' anxiety, raise students' motivation, and increase students' confidence. The use of relevance-enhancing strategies in a CBIM language-learning environment offers promise. This study investigated the effects of intrinsic motivation and embedded instructional strategies designed to enhance relevance on students' perceptions of motivation as well as students' understanding of the instructional material within a computer-based interactive multimedia (CBIM) lesson for college English as a foreign language students.

Background

In recent times, a major trend in pedagogy related to second language learning has arisen from the realization that knowledge of grammatical forms and structures alone does not adequately prepare learners for effective and appropriate use of the language they are learning. Researchers have claimed that there should be a shift in emphasis from the structure and form of language to communicative meaning. They have argued pointedly that the ultimate goal for language learning and teaching is to help learners develop communicative competence (Berns, 1990; Savignon, 1997). Hence, communicative language teaching (CLT) researchers have identified new pedagogical orientations and suggested that communicative approaches are needed in language teaching and learning (Angelis & Henderson, 1989; Berns, 1990; Savignon, 1983, 1997; Underwood, 1984). In order to help accomplish the ultimate goal of communicative language teaching, Brown (1993) suggested the utilization of technology such as films, videos, and computers.

Keller (1983, 1987) claimed that strategies embedded in instructional materials can enhance the learner's attention to the materials and perceptions of relevance, confidence and satisfaction about learning, which in turn can enhance cognitive performance. Keller and Kopp (1987) argued that embedding relevance strategies can improve motivation and performance and should be used to connect the learning to the learner. Nwagbara (1993) reported positive findings about building a relevance component in instructional material to improve learners' motivation.

CBIM (computer-based interactive multimedia) is an instructional approach that can create a language learning environment that embraces constructivism and interaction (Milheim, 1995) through its multiple roles and unique properties. SLA (second language acquisition) researchers have indicated that the audio-visual and textual resources found within computer applications can aid in building activities to help students develop the various competencies mobilized in communication (Chanier, 1996; Murray, Morgenstern, & Furstenberg, 1991). There is no doubt that CBIM has a promising future for foreign language teaching and learning. However, technology itself cannot help instruction without careful instructional design. Using the unique features of CBIM, integration of appropriate instructional strategies can foster student learning and help learners learn how to learn (Reigeluth, 1983; Wenden, 1985).

This study was conducted to investigate the effect of embedding relevance-enhancing strategies in foreign language classes. The relationship between learners' motivation and embedded relevance strategies was also examined.

Methods

The 2 X 2 factorial experimental posttest-only design was employed with two categorical independent variables, level of intrinsic motivation (higher or lower) and embedded relevance enhancement (with or without), and two continuous dependent variables, achievement and motivation perception. The Intrinsic Motivation Orientation Scale (IMOS), a scale developed by the researcher (Cronbach coefficient alpha was .93), measured the first independent variable, learners' level of intrinsic motivation. Totally 313 subjects were categorized as having a higher or lower level of intrinsic motivation based on their score on the IMOS. The second independent variable, embedded enhanced relevance strategies, was the treatment; strategies were based on the Relevance Concept and Tactics Checklist developed by Keller (1990). Within each intrinsic motivation group, learners were randomly assigned to a treatment consisting of a computer-based instructional multimedia program featuring English language text, videos, and exercises on the topic of criticism either with or without enhanced relevance components. The dependent variables, operationally defines as the score on a comprehension test and the score on the Modified Instructional Material Motivation Survey (MIMMS), were measured after students completed the computer-based interactive multimedia (CBIM) program. Two-way analysis of variance (ANOVA) was used to analyze the data collected.

Data Analysis and Results

The comprehension test means for each of the four treatment groups are shown in Table 1. When comparing scores by Level of Intrinsic Motivation, one can see the Higher Level of Intrinsic Motivation group mean of 11.97 was higher than the Lower Level of Intrinsic Motivation group mean of 10.47. The Higher Level of Intrinsic Motivation group obtained a higher score than the Lower Level of Intrinsic Motivation group in both the control and experimental condition. When comparing means by treatments, the experimental group mean of 12.75 was higher than the control group mean of 9.63. In spite of different levels of intrinsic motivation, subjects who received embedded relevance enhancement obtained higher scores on the comprehension test than subjects who did not receive embedded relevance enhancement.

Table 1 Comprehension Test Means (SDs) for All Four Groups

		Level of Intrinsic Motivation		
	Treatments	*Higher*	*Lower*	*Combined*
Enhanced Relevance	*With (experimental)*	*n = 79* *M = 13.51(4.88)*	*n = 80* *M = 11.99(4.49)*	*n = 159* *M = 12.75(4.73)*
	Without (control)	*n = 76* *M = 10.36(3.79)*	*n = 78* *M = 8.92(3.09)*	*n = 154* *M = 9.63(3.52)*
	Combined	*n = 155* *M = 11.97(4.64)*	*n = 158* *M = 10.47(4.14)*	

The results of the MIMMS for each of the four groups are shown in Table 2. The Higher Level of Intrinsic Motivation group mean of 125.63 was greater than the Lower Level of Intrinsic Motivation group mean of 113.85. The mean for the Embedded Relevance Enhancement group of 123.10 was greater than the mean for the control group of 116.21.

Table 2 The MIMMS Means (SDs) for All Four Groups

		Level of Intrinsic Motivation		
	Treatments	*Higher*	*Lower*	*Combined*
Enhanced Relevance	*With (experimental)*	*n = 79* *M = 130.62(15.19)*	*n = 79* *M =115.58(16.45)*	*n = 158* *M=123.10(17.49)*
	Without (control)	*n = 76* *M = 120.43(15.26)*	*n = 78* *M = 112.10(14.64)*	*n = 154* *M =116.21(15.48)*
	Combined	*n = 155* *M = 125.63(16.01)*	*n = 157* *M = 113.85(15.63)*	

Two-way analysis of variance (ANOVA) was employed to test the research hypotheses. The SAS GLM procedure was used because of unbalanced group size. Overall statistical results (Tables 3) indicate that there were significant differences among groups on both the Comprehension Test [F (3, 309) = 18.25, p = .0001] and the MIMMS [F (3, 308) = 21.50, p < .0001].

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For the comprehension test, there was a significant difference between the two levels of Intrinsic Motivation (F = 10.13, p = 0.0016) as well as between two levels of Embedded Relevance Enhancement (F = 44.46, p = 0.0001). The interaction between levels of Intrinsic Motivation and levels of Embedded Relevance Enhancement was not significant (F = .01, p = .93). The results show that there was a significant main effect of the Level of Intrinsic Motivation and a significant main effect of the Embedded Relevance Enhancement on the comprehension test. Students with higher levels of intrinsic motivation obtained higher scores than students with lower levels of intrinsic motivation. Students who learned from the embedded relevance enhancement program outperformed the students who learned from the no embedded relevance enhancement program. There was no interaction effect between Level of Intrinsic Motivation and Embedded Relevance Enhancement on the comprehension test.

Table 3 Two-Way GLM ANOVA for Comprehension Test and MIMMS

Source	*df*	*Type III SS*	*MS*	*F*	*p*
	Comprehension Test				
Level of Intrinsic motivation	*1*	*172.54*	*172.54*	*10.13*	*.0016*
Level of Relevance Enhancement	*1*	*756.97*	*756.97*	*44.46*	*.0001*
*LOIM * LORE*	*1*	*.13*	*.13*	*.01*	*.93*
	MIMMS				
Level of Intrinsic Motivation	*1*	*10647.05*	*10647.05*	*44.88*	*.0001*
Level of Relevance Enhancement	*1*	*3640.77*	*3640.77*	*15.35*	*.0001*
*LOIM*LORE*	*1*	*876.79*	*876.79*	*3.70*	*.0555*

*Note. LOIM*LORE = Interaction between Level of Intrinsic Motivation and Embedded Relevance Enhancement.*

For motivation perception, the results showed that there was a significant difference between the two levels of Intrinsic Motivation (F = 44.88, p = 0.0001) as well as between the two levels of Embedded Relevance Enhancement (F = 15.35, p = 0.0001) on the MIMMS. The interaction between Level of Intrinsic Motivation and Embedded Relevance Enhancement on the MIMMS was not significant (F = 3.70, p = 0.0555). Results indicated that there were significant main effects of Level of Intrinsic Motivation and Relevance Enhancement on the MIMMS. The MIMMS mean of the Higher Level of Intrinsic Motivation group was greater than that of the Lower Level of Intrinsic Motivation group. Students who learned from the embedded relevance enhancement program outperformed students who learned from the program without embedded relevance enhancement on the MIMMS. The interaction effect between the Level of Intrinsic Motivation and the Level of Embedded Relevance Enhancement on motivation perception was small and not statistically significant.

The findings indicated that the use of embedded relevance strategies facilitates students' language learning regardless of learners' level of intrinsic motivation. Appropriately constructed CBIM instructional materials with embedded relevance enhancement can benefit EFL learners in English learning. The findings of the study also showed that students with higher levels of intrinsic motivation learned more. More highly intrinsically motivated students performed better regardless of the specific treatments they received. Among all four treatment goups, the highly intrinsically motivated students who learned from the program with embedded instructional strategies program performed the best overall. There was no significant interaction between these two variables. However, a possible tendency toward a differential motivational response to the instructional materials was noted; more highly intrinsically motivated subjects tended to be more motivated by enhanced relevance strategies than less intrinsically motivated subjects.

Discussions and Implications

Findings of this study support Keller's (1983, 1987) declaration that embedded instructional strategies can enhance learners' motivation, which, in turn, can enhance cognitive performance. This finding is consistent with previous research showing that incorporating relevance strategies into instructional materials can increase students' motivation (Means, Jonassen, and Dwyer, 1997; Nwagbara, 1993; Sass, 1989). It also supports Keller's (1983) theory of motivation, which argues that learners' motivation can be influenced, and the ARCS model, which provided the set of strategies for improving motivation in this study. The results also indicate that the effects of the two variables are additive. The embedded instructional strategies added to the effect of the existing intrinsic motivation of students. The results of the study suggest that students can learn better when they are notified of the immediate benefit of the instruction they receive; when there are examples included in the material to stress the intrinsic satisfactions of the subject of instruction (goal orientation: present worth). Students learn better when they know what they will be able to do after finishing the instructional materials; when there are examples and exercises clearly related to the knowledge and skills that they will need in the future; when they are told that this instruction will improve their general life coping skills (goal orientation: future value). The results also suggest that learning is facilitated by employing (1) personal language to make learners feel that they are being talking as a person, (2) exercises with feedback, and (3) exercises that stimulate problem solving (motive matching: basic motive stimulation). EFL teachers may draw implications for classroom practice from this research. Teachers should talk with students as people; relate instruction to students' daily lives; and point out how the instructional materials can be used in the real world or in students' lives in the future. Teachers should also try different styles of exercise. Some problem solving exercises, in addition to basic language practice, can help students' learning. Relevance enhancement facilitated students' learning in this study.

The positive findings should encourage teachers and program designers to use embedded instructional strategies either in class or in courseware design. Instructional designers are encouraged to use the ARCS model as a model for designing motivating instruction. Based on the learner assessment, instructional designers can (1) integrate the whole ARCS model into instructional materials, (2) embed one of the components of the model into instructional material, or (3) apply strategies listed on the motivational tactics checklist, to enhance learners motivation and improve learning. Future research should further examine the use of relevance enhancement strategies. Also, other components of the ARCS model, such as attention, confidence, or satisfaction should also be studied for their impact on learning. This theoretical framework offers a rich source of instructional strategies for teachers and instructional designers.

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Pennsylvania State System of Higher Education School Web Site Review for Usability And Information Availability

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Study Design

This study compares and contrasts the web sites of the fourteen Pennsylvania State System of Higher Education schools to identify those that provide efficient, accurate, and effective access to a standardized list of information resources. The study takes a two-fold approach to achieve this goal. By examining the content provided and further analyzing the presentation of that content, an evaluation can be made, and a comparison can be drawn between institutional web sites. The researcher first visited each school's web site in August of 1999 and used the same instrument to revisit the web sites in May 2000 and March 2001 looking for twenty specific pieces of information common to all state system schools.

Each of these twenty items was evaluated based on five criteria:

1. Does the school's site provide the requested information?
2. How difficult is the information to locate?
3. How current is the information?
4. Does the page use appropriate design skills and contain necessary navigational elements (as defined by Patrick Lynch's *Yale Web Style Manual* [Lynch & Horton 1999]
5. Is the page professional in appearance?

A point value from one to five was used for each of the above questions for a total of 25 points. These 25 points could be accumulated for each of the 20 information items that were researched. A total of 500 points were possible.

Assessment criteria assumptions

As the Internet continues to grow, a school's web site is increasing becoming marketing, recruitment, and public relations tools that educational institutions need to closely monitor. A recent survey by the Slippery Rock University Admissions office indicated that the school's web site was second only to family and friends in influencing their decision on applying to the institution [Bracco 2000]. The importance of a school web site outlining accurate and detailed information for prospective students is clear. A well-designed web site providing information that matches the audiences' needs will result in higher enrollment, increased alumni donations, and a greater level of credibility for the institution [McCollum 1999].

This study makes the following assumptions in the collection and analysis of data:

- University sites should all provide a baseline of information resources
- University site visitors should be able to easily locate information without searching deep into a site hierarchy
- University site pages should provide current information
- University site pages should have a professional appearance (good grammar, accurate spelling, consistent layout)

Identification of common information

University web sites are designed to serve a variety of target audiences. These audiences include but are not limited to: prospective students, current students, alumni, institutional employees, community members, researchers, and colleagues. Since university web pages are expected to serve a variety of users, a list of information that these groups might request was generated. That list was refined to twenty items that would be typical of the SSHE institutions. Those twenty items include:

1) Search engine
2) Site Map
3) Tuition and fee schedule
4) Academic Calendar
5) Distance education course offerings
6) Library resources
7) Address of the institution
8) Registrar's name and address
9) How to order transcripts
10) Department listings
11) Academic department chair (English)
12) Mission Statement

13) List of degree and certificate programs
14) Admissions information
15) Name of the President
16) Name of the Provost
17) Calendar of Events
18) Link to State System of Higher Education
19) Faculty directory
20) Alumni page

Data Collection

All data for each of the fourteen schools was collected during the first week of August 1999, the second week of May 2000, and the second week of March 2001. The researcher accessed each web site attempting to locate the information from the list. Search engines, directories, and browsing techniques were used to locate information. The following point scale was used for evaluating question #1; "Does the school's site provide the researched information item?"

5 points – requested information is provided
3 points – some of requested information is provided
1 point – requested information is not located

If the information was not located, the institution received zero points for the remaining four questions. The minimum score any school could receive on any of the items was one point. Therefore, the lowest possible score was 20, and the highest possible score was 500.

Once the information was located the shortest path to accessing the information was determined. Significantly if the information was located via a search engine, the researcher needed to determine how this information was linked to the main page (on what level of the hierarchy did it reside). The assumption for evaluation is that if the user has to review fewer pages to find the requested item, it is easier for them to locate the information. The following point scale was used for question #2, "How difficult is the information to locate?"

5 points – required access of three or fewer pages
4 points – required access of four pages
3 points – required access of five pages
2 points – required access of six pages
1 point – required access of seven or more pages

The web page that contained the requested information was evaluated to determine if the information provided was current. Many pages list a last date of revision. Other dates could be determined by the content on the page. These dates were used for the evaluation. If no date of revision is provided, the researcher assumed that information was current unless there were overt indications otherwise (i.e. calendar of events for a previous year). The following point scale was used for question #3, "How current is the information?"

5 points – requested information is less than 6 months old
3 points – requested information is less than 1 year old
1 point – requested information is more than 1 year

Question #4 evaluated the web pages use of good design skills. Patrick Lynch's *Yale Web Style Manual* provided the standard for evaluation. The researcher looked critically at only the most elementary of design skills. Did links on the page work? Were graphics used on the page able to load? Were consistent navigational tools employed? Were text colors and size appropriate and readable? The researcher limited the evaluation to three responses to question #4, "Does the page use appropriate design skills and contain necessary navigational elements?"

5 points – page uses excellent design skills
3 points – page uses average design skills
1 point – page uses poor design skills

The final question looked at the page's professional appearance. Does the page use proper grammar, punctuation, and spelling? Is the information organized and presented in a logical format? The researcher will again limit the responses to question #5, "Is the page professional in appearance?"

5 points – page is professional in appearance
3 points – page has one or more spelling, grammar, or punctuation errors; or page is poorly formatted
1 point – page has multiple errors and/or is poorly formatted

Data Analysis

Previous reports have discussed the finding of the first two rounds of data collection. This analysis reviews the data collection that took place during the second week of March 2001. The researcher visited each of the fourteen SSHE school websites looking for the informational items. Internet Explorer 5.0 was used with a screen size set to 600 x 800. All sites were accesses via a 56k modem via an independent Pennsylvania Internet service provider. Scores were totaled for all of the twenty information items and a cumulative score was tabulated for each institution. The individual scores for each of the twenty elements for each school can be found in Appendix A. The following table is a summary of the cumulative scores for each of the three past years.

	1999	2000	2001
	Total (Rank)	Total (Rank)	Total (Rank)
Lock Haven	341 (11)	421 (4)	486 (1)
California	368 (8)	409 (6)	468 (2)
Millersville	398 (4)	463 (1)	466 (3)
Clarion	392 (6)	394 (8)	462 (4)
Mansfield	319 (13)	363 (11)	460 (5)
Slippery Rock	400 (2)	399 (7)	439 (6)
Bloomsburg	369 (7)	420 (5)	433 (7)
Shippensburg	393 (5)	394 (8)	431 (8)
Indiana	393 (3)	451 (2)	425 (9)
Kutztown	339 (12)	384 (10)	423 (10)
West Chester	432 (1)	439 (3)	414 (11)
East Stroudsburg	343 (10)	350 (12)	414 (11)
Edinboro	360 (9)	319 (13)	346 (13)
Cheyney	280 (14)	254 (14)	316 (14)
mean	366	390	427

Table 1 Cumulative scores and rankings for the past three years for each of the fourteen Pennsylvania State System of Higher Education schools.

The average total score has increased each year, and this has had an impact on schools' rankings. West Chester, who ranked 1st after the year of data collection, is now ranked 11th because their score decreased by 18 points over the three year period. Shippensburg, who has seen an improvement in their score each year, has fallen from 4th to 8th position. The lesson to be learned is that if you are not actively working to improve your site, you are falling behind the competition. A web site is a constantly evolving product that needs to be actively molded, revamped, and updated. A stagnant site reflects poorly on an institution and is not accomplishing and promoting their mission.

These scores reflect a snapshot of institutional web pages during the collection period. They are a single perspective on usability and information availability to help schools identify weaknesses in their sites.

Summary

Users are frequently relying on more advanced navigational aids to find information. The need for a search engine and a site or index map has become increasingly more important. Because of the quantity of information that is being delivered at most of the institutional sites, the location or organization of information in the hierarchy is not always intuitive. Some links fall under department's representative areas as a result of institutional history rather than traditional form. The number of schools that provide search engines jumped from five in 2000 to eleven in 2001. The three schools that do not provide a search engine on their site recorded the three lowest scores. Only six of the schools currently provide a site map or site index. The schools that did provide a site map provided an outline view of the site hierarchy. A few schools used the site index approach, which alphabetized all the major pages located on the site. The researcher found the alphabetized approach easier to locate specific information.

Several of the information items that were searched for are well represented at all the institutions. All schools recognize the importance of providing admissions information, library links, an academic calendar, and the address of the institution. All but one of the schools provided tuition and fees information, registrar's name, transcript information, department listings, the chair of the English department, a link to the State System web page, faculty directory and an alumni page. There is confusion at some sites concerning the distinction between department listings and degree programs. One site provided identical links to both listings. The listing of degree programs offered by an institution is a critical element to be linked on the admission or prospective student areas. By forcing students to search through the department listings, schools risk alienating the student because the information is difficult to locate or may not be available at the department level.

The required element that generated the highest mean score was the academic calendar. In March 2000, the department listings provided the highest mean score. The academic calendar provides critical information to those on campus, but also to prospective students, off-campus organization, and those at sister institutions. It is no surprise that the administration sees the academic calendar as an imperative in constructing a web site.

There is little argument that the Internet, web design, and institutional sites are in the early stage of their evolutionary process. The playing field continues to change, and standards are modified as hardware, software, and user behaviors change. Designers must attempt to create pages that reflect current usage statistics for their audience.

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A recent study by Mycomputer.com revealed that 49.5% of users are reviewing web pages with a screen resolution of 600 x 800 and that less than 10% of users still use 640 x 480 as their preferred resolution size [Lake 2001]. While these types of hardware and software profiles change over time, current designers need to create screens that meet the profiles of the majority of their visitors. Therefore as pages were analyzed for this study, they were reviewed using a screen resolution setting of 600 x 800. If the schools' pages did not format correctly to this screen size, points were deducted related to graphic design. A few schools had home pages that were designed for 1024 x 768 screen sizes. This caused the content to be cropped and forced the user to scroll down and to the right to review all the information.

For the first time this study collected data on how long it takes for an institutions web page to load. A recent Jupiter Research survey showed that 84% of users indicated that they left sites because of slow or broken links [Lake 2001]. Optimizations of images and being cognizant of the total file size for the university's main home page is an imperative factor in web site design. The researcher used a 56k modem on a 550mhz PC connected to a Western Pennsylvania Internet service provider. The data was collected between 11 a.m. and 12 p.m. on a Friday. This time was selected to test the schools' sites during a period when it would normally be receiving heavy traffic. Given that 88% of households connect to the Internet at 56kps or less, it is easy for designers at institutions with T3 line access to forget that download times can be critical [Lake 2001].

The data collected on download times was not factored into the final score for each school. Future studies may include a factor related to download times. The collection of this information came from the researcher's frustration of slow download times while reviewing the individual sites. One of the SSHE school's home page took over six minutes to load, while the average for the schools was over three minutes. Perhaps some of the slow response time can be attributed to SSHEnet, the State System of Higher Education Network. If the bottleneck for delivery is the network, SSHE schools still need to take this into account as they design pages, particularly pages for prospective students, alumni, or other outside groups. Many of the schools that reported low times had extensive graphics files (some with over 60 files) or rotating color slide shows on their home page. Edward Guttman, lead designer at Viant, a web development firm, notes, "Only if you can prove that users will get added value through enhanced site features are they worthwhile" [Lake, 2001]. While these slideshows may provide wonderful images from the admissions view book, their slow load time outweighs any aesthetic value they may add to the page.

Shippensburg and a few other schools have begun to address the multi-audience design considerations through the use of an Intranet, a portion of their web site designed primarily for on-campus personnel and students. While some off-campus access takes place on this Intranet, the design considerations can reflect that most of the users will have high speed access. This strategy may be appropriate for some of the schools.

One school still uses a cover page on their site. Cover pages are graphical pages that load as a preamble to a site. They provide minimal content and usually only one or two links to proceed into a site. Their effectiveness verses their annoyance has been debated [Lynch & Horton 1999]. The majority of site critics feel they simply create an additional barrier between the user and the content. However, they can provide some functionality by preloading images for graphically intensive sites.

After the completion of the data collection, a follow-up question was sent to each of the schools asking, "Do you employ a full-time webmaster?" and "What division in the institution is responsible for maintaining the school's web site?" The following table provides the results of these questions for each of the schools.

Ten of the fourteen schools indicate that they have full-time webmasters, although Shippensburg splits this responsibility between two people. The top five schools in the study analysis all have full time webmasters.

The responsibility of the web site broke into two distinct areas, although sometimes this was a shared effort. Seven schools indicated that the Advancement or Public Relations (normally a division of Advancement) areas were primarily responsible for the content and updating the schools' pages. Four schools indicated that an Information Technology area held that responsibility. Three schools have joint responsibility between the IT and Advancement/Public Relations areas. The top four schools in the instrument analysis either had Advancement/Public Relations or joint responsibility.

	Webmaster	Division
Lock Haven	Yes	Advancement
California	Yes	PR
Millersville	Yes	IT/PR
Clarion	Yes	Advancement
Mansfield	Yes	IT
Slippery Rock	No	IT
Bloomsburg	No	Advancement
Shippensburg	Yes*	IT
Indiana	Yes	Advancement
Kutztown	Yes	IT/PR
West Chester	Yes	IT
East Stroudsburg	No	Acad Comp/PR
Edinboro	No	PR
Cheyney	Yes	Advancement
	* Two 1/2 time	

Table 2. "Does the institution employ a full-time webmaster?" and "What division at the institution is responsible for maintaining the school's web site?"

A few years ago it was easy to determine the area of responsibility of a school's web page by looking at the images and information organization. Schools that attempted to replicate their view book in the first few pages of the hierarchy were normally created by public relations areas. School's web pages that pushed items like e-mail instructions or ftp links in the upper levels of the site were probably developed by the IT divisions. While these distinctions are not as clear today, there are design issues that are addressed differently by both areas. The IT area may sometimes choose solutions that are technologically efficient and require less maintenance. For instance, the choice of searchable databases for faculty and staff directories may be determined by software availability and efficiency rather than usability. In contrast, sites developed by advancement areas may become too graphically intensive and slow to load in an effort to accomplish the "branding" requirement.

In the brief period of time that this study has been conducted, a maturation of many of the SSHE school web sites has taken place. Early sites relied heavily on organizational structure to dictate the organization of information on institution's web site hierarchy. Next came the revelation of designing for the audience and sites grouped all their content around audience expectations. Many sites have now moved to a hybrid model melding the two with a heavy focus on the audience but some additional organizational structure from the institution included. The past three years has seen a consistent improvement of most SSHE school web sites, however the work is never complete. Schools need to be constantly, reevaluating their audience, reviewing their content organization, and revising their pages to reflect the changing dynamics.

Suggestions for Further Research

Several follow-up or study reviews may be incorporated in future reviews. The researcher felt that the top rated site was not necessary the most aesthetic of the sites. The instrument does a much better job of evaluating the information architecture of a site rather than the visual design. Perhaps a second phase of this study could review just the graphic design.

One way to provide credibility to this study would be to identify a correlation between these ranking and inquires for applications and enrollment. In theory, schools with better web sites should see an increase in inquiries, particularly electronic inquires. After three years of using the same information items, it is probably time to generate a new list for review. A review of the SSHE imperatives document may provide ideas for new items to include. In addition, some schools may become savvy of the study and specifically improve their pages to score higher.

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Selecting Computer Mindtools: A Tool for Constructivist Learning

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Introduction

A number of media selection models have been introduced over the last few decades (Anderson, 1976; Briggs and Wager, 1981; Gagne and Briggs, 1979; Gropper, 1976; Kemp, 1980; and Reiser and Gagne, 1983). These models were designed to assist educators and trainers in selecting the most appropriate media for an instructional situation. A common assumption undergirding these models is that instruction is based on a transmission model of learning in which an instructional medium (e.g., computer, teacher, television) delivers or transmits an instructional message to a learner. This assumption is often inadequate for educators interested in selecting media for constructivist learning environments.

From a constructivist learning perspective, students do not learn "from" technology, but rather "with" technology (Jonassen, 2000). The concept of learning with technology focuses on the intellectual partnership between the learner and the computer. Jonassen refers to computer technologies applied in this manner as Mindtools. These tools partner with learners to engage and facilitate higher order learning and critical thinking. Using Mindtools in schools is often more feasible than other computer applications because Mindtools are relatively inexpensive and they are often already available.

This tool was developed to help educators make informed decisions about the most appropriate Mindtool for students to partner with in specific instructional situations. Instead of focusing on transmission attributes of media (e.g., motion and/or sound capabilities), the tool interacts with and asks educators to specify the critical, creative, or complex thinking skills they want students to develop within a given content domain. Once this information is entered, the educator is given a prioritized list of Mindtools and activities that could effectively be used to help students develop the higher-order thinking skills specified. It will be useful to all educators who are interested in resources that can support their efforts in designing constructivist learning environments.

Constructivist Learning Environments

Constructivists believe that we construct our own knowledge based on our own experiences with reality, through reflection on our interactions with objects and ideas (Brooks & Brooks, 1993). From this perspective, learning occurs through the continual creation and revisions of rules and hypotheses to explicate what is observed (Brooks, 1990). Learners act more like active participants rather than passive recipients during the learning process. In the learning process, each person is continuously examining new information with respect to old rules. Rules are revised when discrepancies appear until reaching new understandings or constructions of reality.

Based on the belief that we learn by constructing our own understandings of reality, contructivist learning environments should be student centered, allowing students to take an active role exploring, inquiring, and solving problems. In addition, educators should encourage students to experience an abundance of objects and ideas while empowering them to ask their own questions and seek their own answers to the complexities of reality. This pedagogical perspective often leads to assignments and materials that are interdisciplinary and integrated and to instructional methods that focus on student-to-student interaction. In such learning environments, students are more likely to take risks and approach assignments with a willingness to accept challenges to their current understandings (Brooks & Brooks, 1993). Such environmental conditions honor students as emerging thinkers and engage students' active understanding with reference to past experiences and personal purposes.

Brooks (1990) stated that models of learning based on constructivist principles suggest a sequence of lessons in which exploration comes first. In contrast, traditional instruction often focuses on information dissemination for the majority of instruction and may only introduce exploration after all the material has been "taught". Brooks (1990) suggested a three-stage model from constructivist-based science education as a means of applying constructivism across the curriculum: the exploration stage, the invention stage, and the discovery stage. Using this model, teachers engage students with lesson concepts by allowing them to explore materials or information (exploration stage), then by formally introducing the concepts (invention stage) and finally by providing students with further activities (discovery stage). This sequence enables students to develop a robust usable knowledge base within a domain.

Constructivist learning is a complex interaction between the students' disposition, personal purposes, prior knowledge, and the requirements for specific subject-matter inquiry (Henderson, 1996). In constructivist learning environments, instead of asking the learners to memorize and practice rote skills, educators inspire and facilitate meaningful inquiry learning.

Mindtools for Constructivist Learning

Mindtools can be an especially effective way to augment contructivist learning experiences in the classroom. Mindtools depart from the conventional use of instructional technology because of the intellectual partnership that is created between the learner and the computer. In other words, when the learner works with the computer, the learner enhances the capabilities of the computer, and the computer in turn enhances the thinking of the learner (Jonassen, 2000). In this way, the computer becomes an intellectual tool that learners can use to engage and facilitate critical thinking and higher order learning. Jonassen explains that the properties of Mindtools enable learners to make more effective use of their mental efforts and create knowledge that reflects their comprehension of the information rather than replicating the teacher's presentation of information (p. 10). When students use Mindtools, knowledge is built by the student, not provided by the teacher.

When teachers use Mindtools to promote meaningful thinking, they facilitate learning by incorporating appropriate Mindtools to help students think critically about the subject matter. Lessons are effectively implemented by using exploration, invention, and discovery as the framework for classroom learning experiences. Using Mindtools in schools is often more feasible than other computer applications because they are relatively inexpensive and they are already available in most schools. However, as Jonassen suggests, there is no reason to limit the concept of Mindtools to computer-based resources alone. Any medium that supports knowledge construction, manipulation, representation, exploration, communication, and reflection could be considered a Mindtool.

The Computer-based Tool for Selecting Computer Mindtools

Although computers have been used for teaching and learning for a long period of time, the idea of making use of computer Mindtools is still pretty new to educators. A search of the WWW and the literature yielded few resources or research that addressed the integration of Mindtools in the practical teaching and learning environment, the school. There were numerous broken links, which were meant to link to the pages relevant to Mindtools, all over the Internet. In addition, there were misconceptions or misunderstandings about Mindtools in current Internet resources. Teachers have access to few resources to assist them in designing lesson that incorporate Mindtools and have little opportunity to get familiar with using Mindtools in their classrooms. It is confusing and frustrating. In order to help educators to implement Mindtools, a computer-based tool for selecting computer Mindtools is being designed. This tool would utilize a database web server to provide educators examples or suggestions according to the educators' specific needs and inquiries. This easy to use tool will assist educators to include the utilization of Mindtools in the learning environment which should ultimately increase the critical thinking skills of the students. This session will discuss and explore the development of this selecting tool, how it is evolved.

Selecting media for instruction (Reiser & Gagné, 1983)

A number of media selection models have been introduced over the last few decades (Anderson, 1976; Briggs and Wager, 1981; Gagne and Briggs, 1979; Gropper, 1976; Kemp, 1980; and Reiser and Gagne, 1983). These models were designed to assist educators and trainers in selecting the most appropriate medium for an instructional situation. A common assumption undergirding these models was that instruction is based on a transmission model of learning in which an instructional medium (e.g., computer, teacher, and television) delivers or transmits an instructional message to a learner. This assumption was perhaps best articulated by Reiser and Gagne (1983) when introducing their media selection model by defining media as " . . . the physical means by which an instructional message is communicated" (p. 5). They further stated that educators and trainers are faced with the " . . .problem of choosing the appropriate media to deliver an instructional message" (p. 3). The focus on media as the communicator or deliverer of an instructional message is consistent with many traditional models of instruction (Salomon, Perkins, & Globerson, 1991). However, this assumption is often inadequate for educators interested in selecting media for constructivist learning environments. This assumption is what Jonassen would call "learn from computers." The leaner under this assumption merely receives instructional massages from the media and learns with a passive role. Neither the interaction nor the partnership with the media is encouraged or promoted.

Discrepancies of Reiser & Gagnés' assumption for constructivist learning environment

Based on the assumption of media as " . . . the physical means by which an instructional message is communicated" (p. 5), Reiser & Gagnés' media selection model implies that media are merely delivery tools not cognitive tools. There are several discrepancies in applying Reiser & Gagnés' media selection model to a constructivist learning environment. First of all, Reiser & Gagnés' media selection model the model focuses on selecting media based on the transmission attributes of media (e.g., motion and/or sound capabilities). Selection of media as cognitive tools to engage students' thinking is not addressed in this model.

Second, Reiser & Gagnés' media selection model focuses on providing sound guidelines to instructional designers. In the introduction part of Reiser & Gagnés' media selection model, it indicated that it is "aimed primarily at instructional designers...who design and develop instructional materials" (p. 7). In other words, it is not primarily tailored for classroom teachers or educators who implement their teaching or instructional materials on daily or weekly basis in a practical learning environment, nor does it meet the needs of a constructivist learning environment. Although claimed to be of value to instructors and classroom teachers, their model is only for selecting "media for supplementing or supplanting some of their in-class teaching activities" (p. 7). In a constructivist learning environment, media should not be just for supplementing or supplanting teaching activities but engaging students to think critically.

Third, users need to cross off media which are not feasible in the situation for which instruction is being designed after they have used Reiser & Gagnés' media selection model to identify the appropriate media for them. In other words, users have to identify the appropriate media regardless to the feasibility or availability at the first place. At the end, users might not be able to use any of the selected media that Reiser & Gagnés' media selection model suggests. Moreover, users have to consider the necessity and the comparative costs to make final choices. Consequently, using Reiser & Gagnés' media selection model is still a complicated decision making process. It is time-consuming for classroom teachers and educators to implement Reiser & Gagnés' media selection model. It is another extra workload to their already tight and busy schedules.

Descriptions/constructions of our selecting tool

Mindtools are cognitive tools. Students work with Mindtools in terms of partnerships. Consequently, students and Mindtools empower each other's capabilities, especially the thinking and learning of students and the potentials of Mindtools. Mindtools are readily available and can be used in all kinds of content areas. As a result, Mindtools are the best "media" to the constructivist learning environment. In order to promote the uses of Mindtools and help educators who are interested in applying Mindtools to their teaching, the idea to construct an extendable and applicable Mindtool database resource was developed. In consideration of the availability and the ease to use of the WWW to every educator, it was decided to build a database web server for selecting computer-based Mindtools. This tool is intended to help educators make informed decisions about the most appropriate Mindtool for students to partner with in specific instructional situations. The tool interacts with and asks educators to specify the critical, creative, or complex thinking skills they want students to develop within a given content domain. Once this information is entered, the educator is given a prioritized list of Mindtools and activities that could effectively be used to help students develop the higher-order thinking skills specified. The selection tool employs five steps to guide users in the identification of appropriate Mindtools. Users will first be asked to specify content area and the grade level. Next, users need to select concepts, the desired critical cognitive thinking skills of students to engage, and check the availability of their computer applications, all from pre-decided menus. Then, based on the input of users, a prioritized list of Mindtools with short descriptions of example activities and guidelines to construct new activities is provided. Items on the prioritized list are links connecting to corresponding pages of examples stored in the database web server for selecting Mindtools.

Discussion and Conclusion

The tool is still under development. It is not a sound product yet at this point. It is the idea that counts for the purpose of helping educators to select appropriate Mindtools for their constructivist learning environments. However, this presentation will still show how this tool works practically. Sample pages will be provided to illustrate the constructions of the idea of this Mindtool database web server.

The functions to identify inputs are embedded on web pages. Queries are sent to the database server in terms of submitting web forms. Data are retrieved from the collection of the database. Then, results are returned and shown on users' web pages using server side scripting language. In other words, in order to develop this database web server for selecting Mindtools, a database server, a server side scripting language, and a Web server are required. In this case, we are using MySQL as the database server that serves databases, PHP as the server side scripting language that connects a database server to fetch information and sends the information to users' web browsers as designed web pages, and the Unix Web server of Texas Tech University. MySQL and PHP are chosen because of their free distributions and their availabilities. Moreover, MySQL and PHP are compliant with the Unix Web server of Texas Tech University.

The Mindtool database is built based on Jonassen's book "Computers as Mindtools for Schools." We used Jonassen's terms to specify the types of Mindtools as well as the computer application software. The terms for the desired critical cognitive skills are put together based on various resources regarding to critical thinking. The lists of content and subject areas are relevant to what is taught at secondary schools. However, building the database is much of work. While working on sample activities, we confront a serious problem regarding to content and subject areas. It will be very difficult and unreasonable to build the content and subject specified activities without consulting with real content experts. It needs content experts to design and create lesson plans and activities.

Moreover, if the database we are building is a closed collection, the resources for educators who are interested in Mindtools will be unexpandable and remain limited. In order to have the database possess the capability of ongoing expansion, we have decided to add a function, other than guidelines to help users to create lesson plans and activities, which allows any potential user to contribute their creative activities to the collection of the database. We believe that once the user is more familiar with the application of Mindtools, they will be more ready to create their own or to contribute their ideas to the database. The contribution function is tailored for them. Nevertheless, not every contribution is published or added to the database automatically. To prevent false example activities or misconceptions of applying Mindtools, every contribution is sent to a reviewer first prior to be a part of the database. Full considerations are necessary and also take much time and efforts. In other words, the development of this Mindtool database web server requires all kinds of participations on technical solutions, content specified expertise, ongoing reviewing, continual revision, and user engagements. This selection tool for Mindtools is meant to be a collaborative work. By working with the collaboration of all aspects, this tool will work more effectively.

It is not possible to construct this tool soundly without involving intended users. That is one of the reason that the tool is to be on the Internet. This tool is made to be a share resource of Mindtools.

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Effects of On-Line Peer-Support on Learning During On-Line Small Group Discussion

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Abstract

The purpose of this study is to investigate learning effects of on-line peer-support for generating critical questions and counter arguments in small group on-line discussion. The on-line peer-support includes descriptions of what to do and generic and domain specific examples of questions. About forty five students were recruited from an on-line introductory class on turfgrass management offered by a land-grant university. A field experimental time series design with control-group was employed. Data were collected from five discussion sessions, ten open-ended essay exams, and three multiple-choice exams through a semester. The results indicated that the peer-challenge guidance helped learners to generate more challenges ($F=2.465$, $p < .05$). But, it did not improve the quality of challenges. The increased quantity of challenges alone might be not sufficient to activate learners' reflection and critical thinking or to improve meaningful interactions. Consequently, it did not influence learning, performance in multiple-choice questions on memory and comprehension and open-ended essay questions.

Background to the Problem

On-line discussion has become one of the most popular strategies used in on-line distance education as well as on-site education at the college level. For example, most on-line education support systems (e.g. WebCT) include various forms of computer supported communication functions, such as list-serve and bulletin board systems (Abowd, da Graca Pimentel, Ishiguro, Kerimbaev, & Guzdial, 1999; Hsi & Hoadley, 1997). In fact, many on-line instructors use these functions to encourage learners to be involved in discussions about target topics (Berge, 1997; 2000). Meaningful discussion helps learners to construct their own knowledge by providing several cognitive benefits such as *articulation*, where learners articulate their understanding, perspectives, or opinions; *cognitive conflicts*, where learners reflect on new knowledge to justify or defend conflicting positions; and *co-construction*, where learners share and refine meaning with peers in a social context (Crook, 1994; Jonassen, Peck, & Wilson, 1999; Koschmann et al., 1996; Tao & Gunstone, 1999b). Although on-line discussion has been used largely with these expectations for learning benefits, the actual effects are unclear. In cases where simple question-answer cycles are employed, students do not become actively involved in critical thinking processes. These non-thoughtful interactions are not sufficient to promote active, knowledge construction.

One possible reason for the lack of reflection during on-line discussions is that students do not know what to ask or how to ask questions (Miyake & Norman, 1979; van der Meij, 1990). Peer interactions can be initiated when learners raise thoughtful questions or provide critical feedback; however, in order to propose important questions or thoughtful feedback, question-askers need to have a certain level of domain knowledge and to activate metacognitive skills such as reflection, monitoring and evaluation (Dillon, 1986; Miyake & Norman, 1979; Palincsar & Brown, 1984; van der Meij, 1990; Wong 1985). Unfortunately, novice learners who begin to explore a new domain are often limited in those metacognitive skills, so they can neither ask the right questions nor generate productive feedback. It is a "metacognitive knowledge dilemma" (Land, 2000), whereby effective monitoring and reflection is linked to having some prior domain knowledge (Garner & Alexander, 1989).

This dilemma provides an essential need for developing on-line instructional strategies that can guide meaningful on-line discussion between or among peers (e.g. Abowd et al., 1999; Scardamalia & Bereiter, 1996a). Specifically, learners' generation of questions or feedback needs to be supported to lead meaningful discussions (Brown, 1989; King, 1994; King & Rosenshine, 1993; Palincsar & Brown, 1984; Scardamalia & Bereiter, 1991; van der Meij, 1998).

Purpose of the Study

This study develops a framework intended to overcome the metacognitive dilemma and to facilitate effective peer interactions in on-line discussion. This framework assumes that novice students who lack domain knowledge and cognitive skills can be supported in generating meaningful interactions at an early stage of learning (King & Rosenshine, 1993; Palincsar & Brown, 1984). The resulting questions and feedback in turn can enhance peers' metacognition, such as reflecting and monitoring, which allows them to refine and restructure their domain knowledge (Piaget, 1985; Webb & Palincsar, 1996). This framework for peer-challenge support has three assumptions. First, on-line support for students to generate meaningful challenges can increase the quality of students' questions and feedback by providing externalized support for metacognition (Palincsar & Brown, 1984). Second, in order to receive learning benefits from on-line discussion, such as articulation, cognitive conflicts, and co-construction of knowledge (Crook, 1994), this peer-challenging strategy should guide specific types of challenges that facilitate these learning activities (Forman & Cazden, 1985). Thus, effective types of challenges should be questions that seek missing information from learners' explanations, counter arguments that contradict learner's opinions, and more systemic questions such as hypothetical questions that force learners to consider complex contexts and various perspectives. Third, once the quality of peer-generated challenges is increased, meaningful cycles of verbal interactions should be initiated. When learners receive critical, valuable, reasonable, and sophisticated questions or challenges from their peers, those challenges and interactions should magnify learner's cognitive dissonance and trigger a conscious cognitive process to re-construct and enhance existing understanding. Thus, the purpose of this study is to test this peer-challenge support framework by investigating the effects of on-line support for peer challenges on discussion activities and learning of college students.

Research Questions

Question 1: Does the use of on-line guidance for generating effective peer-challenges affect students' on-line challenging behaviors such as types of challenges generated, clarity of challenges, and clarity of rationale in challenges during small group on-line discussion?

Question 2: Does the use of on-line guidance for generating effective peer-challenges affect students' on-line discussion activities (frequency of interactions, threaded responses, and off-task interactions) during small group on-line discussion?

Question 3: Does the use of on-line guidance for generating effective peer-challenges during small group on-line discussion affect students' performance in memory and comprehension?

Question 4: Does the use of on-line guidance for generating effective peer-challenges affect changes in students' performance of open-ended essay questions during small group on-line discussion?

Methods

Participants

About forty five students were recruited from an on-line introductory class on turfgrass management during the 2001 spring semester, which is regularly offered from a land-grant university in the northeastern United States. The audience for this on-line course has no restriction in their location and time. They can be full- or part - time students working toward either a degree or a certificate. In the 2001 spring semester, the majority of the participants were part-time male students who pursued a certificate for turfgrass management. The participants were randomly assigned to a small group of five to six members. Then those small groups were randomly assigned to either experimental or control group.

Discussion tool and intervention

An on-line discussion tool used for this class is called Collaboration and Negotiation Tool for Case-Based Learning (Conet-C version 1) and was designed by the authors.

Guidelines for effective peer-challenges were embedded into the discussion tool to facilitate learners' generation of three different types of challenges to their peers' initial answers: clarification questions, counter arguments, and context - or perspective-oriented questions.

Clarification questions are peer-generated questions seeking additional information from learners' initial answers for clarifying or elaborating the learners' ideas. These questions identify missing information, indicate unclear parts, and detect errors in learners' initial explanations on given topics. This type of peer-challenge could facilitate learners to elaborate/articulate their idea, explain these idea clearly, and correct their partial misunderstanding (Koschmann et al., 1996; Tao & Gunstone, 1999a).

Counter arguments are peer-generated opinions expressing disagreements with learners' initial ideas. Unlike clarification questions, these opinions identify major differences between peers' and users' understanding on given topics. This type of peer-challenge generates explicit cognitive conflicts which could encourage learners to justify their positions, reconstruct their misconceptions, and negotiate their understandings (Tao & Gunstone, 1999a).

Context-/perspective-oriented questions are hypothetical questions changing critical factors in given problem situations or considering different perspectives on the problems. Unlike clarification questions or counter arguments, these challenges do not indicate any specific problem with learners' responses. Instead, these challenges could stimulate learners to systemically think about dynamic aspects of the problems beyond the levels of the assigned questions. This type of peer-challenge could facilitate learners to generate predications and explanations.

Procedure

Small groups of students were asked to answer the same set of five or six open-ended essay questions in five sessions of on-line discussion throughout the semester. At each session of discussion, students in each group were asked to answer their assigned question and post their answer within a week, so the initial answers were available for group members to review. Then, each student was required to ask questions or to provide different opinions at least two times to group members in each discussion session. At the same time, each student was asked to answer peers' questions or counter opinions about his/her initial answer. After completing each on-line discussion (approx. 1 week), each student revised his/her initial answer and submitted the final answer to the instructor.

During the first two discussion sessions (pre-observation), there was no treatment given to the groups. After finishing the second discussion session, all students took a multiple-choice exam (pretest for memory and comprehension) in their local area administered by local librarians. In the third and forth discussion sessions (treatment observation), the guidance for effective peer-challenges was presented to only the experimental group through the on-line discussion tool. After finishing the forth discussion session, another multiple-choice exam (post-test) was administered. In the fifth discussion (post-observation) no treatment was given to the groups. After this last discussion, the last multiple-choice exam (delayed and transfer test) was administered.

During each discussion session, students' on-line verbal interactions and their initial and final answers for the given open-ended essay questions were recorded in a computer database for later analysis.

Independent variables measured

The followings are a list of independent variables measured.

- Challenging activities
  - Challenge types: frequency of peer-generated clarification questions, counter arguments, and context-/perspective oriented questions.
  - Challenge clarity: how clearly peer-generated questions or disagreement points are described.
  - Challenge-rationale clarity: how clearly rationales for challenges are justified.
- Discussion activities
  - Interactions: frequency of all postings
  - Threaded responses: the number of postings under one issue
  - Off-task discussions: frequency of off-task postings
- Learning outcomes
  - Multiple-choice tests of memory and comprehension
  - Open-ended essay questions

Results

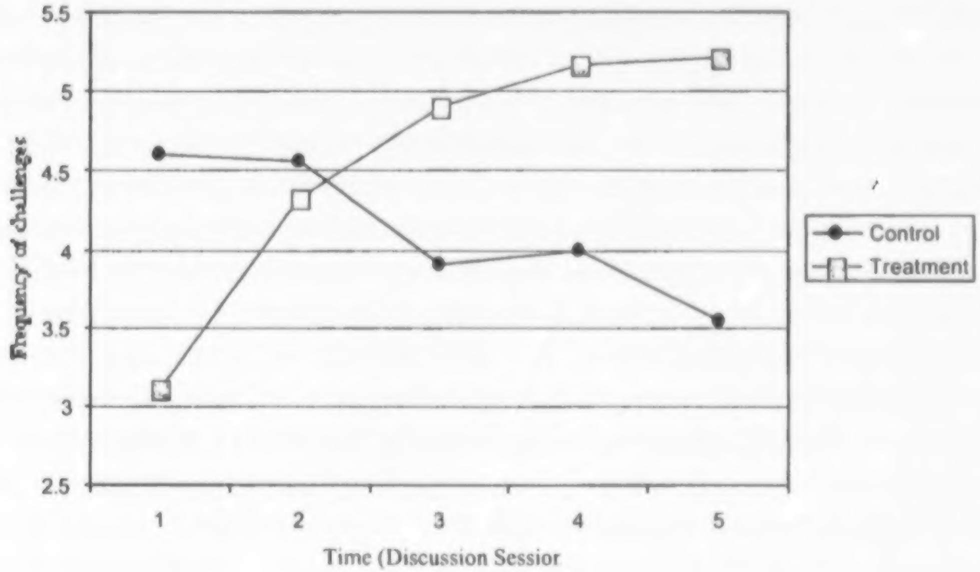
Effects on on-line challenging behaviors

The frequency of three types of peer-generated challenges (clarification questions, counter arguments, and context-/perspective-oriented questions) were counted from the five discussion sessions respectively. According to the results of ANOVA repeated measures on the total frequency of three types of challenge generated during discussion sessions (see Table 1), there was a statistically significant interaction effect for time and groups (F = 2.465, $p < .05$). The result indicates that the treatment group generated more challenges than the control group during and after treatment sessions (see figure 1). In the post-hoc analysis, however, it failed to find specific time points and types of challenges that were attributable to the significant interaction effect.

Table 1. Results of ANOVA on total frequency of three types of challenges

Source	Sum of Squares	df	Mean Square	F	Sig.
Time*	3.995	4	.999	.466	.761
Time X Group	21.137	4	5.284	2.465	.048
Error (Time)	317.229	148	2.143		

Figure 1. Total frequency of three types of challenges between control and treatment groups across five discussion sessions.



In order to obtain the scores for challenge clarity and challenge-rationale clarity, the challenges posted during discussion sessions were also evaluated by two judges according to rubrics. The results of ANOVA with repeated measures did not show any significant differences between two groups in both challenge clarity (F = .608, p. < .658) and challenge-rational clarity (F = .356, p. < .839) across discussion sessions.

Effects on on-line discussion activities

The frequency of all postings and off-task postings were counted throughout the five discussion sessions. Also, the average number of postings under each issues (threaded discussions) was calculated by dividing the number of issues into the number of all postings. The results of ANOVA with repeated measures of the on-line discussion activities did not show any significant differences between the two groups across all discussion sessions in the frequency of postings (F = .832, p. = .507) or off-task postings (F = 1.227, p < .302). In addition, the results of threaded discussions calculated from each small group did not show any consistent patterns of the curve in the average postings under each issue. This indicates that there are no clear differences between the two groups in threaded discussions.

Effects on memory and comprehension tests

The multiple-choice scores on memory and comprehension from pre-, post-, delayed-, and transfer tests were collected and analyzed by ANOVA repeated measures. The ANOVA results did not show any significant difference between the two groups in the scores across all tests (F = .060, p = .981).

Effects on changes in open-ended essay questions

The initial and final answers of students on the open-ended essay questions in each discussion session were collected and evaluated by two judges according to given rubrics. The ANOVA results did not show any significant difference between the two groups in the gain scores made from initial to final answers across all discussion sessions (F = 1.101, p = .358).

Discussions

In summary, the results indicated that the peer-challenge guidance helped learners to generate more challenges. But, this did not improve the quality of challenges. The increased quantity of challenges alone might not be sufficient to activate learners' reflection and critical thinking or to improve meaningful interactions. Consequently, this did not influence learning or performance on multiple-choice questions of memory and comprehension and open-ended essay questions on higher order thinking.

One likely reason for the failure of the treatment to improve the quality of challenges may be that students did not frequently refer to the on-line guidance; it was not strongly emphasized by either the instructor or the interface of the on-line discussion tool.

Instead, it was simply recommended by the instructor only twice during the treatment discussion session through the instructor's announcement board. Thus, students may not have paid attention to the guidance during discussions. In addition, the interface design of the discussion tool may not have strongly encouraged students to look at and use the guidance; students in the treatment group were required to voluntarily seek this guidance by clicking on the guidance icon. Most students reported on a survey collected at the end of the semester that they referred to the guidance only one or two times during the treatment discussion sessions.

Possible solutions to these limitations involve changes to the interface design and class administration, although these might generate additional problems. The guidance, for example, could be re-designed to open automatically whenever students open the discussion window. But, students might want more control without being "forced" to view the guidance for every posting. Another possible solution might be to provide a template for generating effective challenges that required them to go through all steps in order to post their challenges. If, however, we use more sophisticated interfaces for on-line guidance, then we may lose the feasibility of large-scale use of on-line strategies because instructors might find it difficult to incorporate such interface-dependent strategies into the generic discussion tools they use currently. Lastly, instructors might strongly emphasize the use of on-line guidance to students by sending messages to them more frequently.

Although the current study did not find significant effects of using on-line guidance on discussion activities and learning, it showed very reasonable results indicating that the quality of challenges could be essential for meaningful discussion and learning. Further studies need to be focused on finding ways to improve the quality of challenges and need to be tested again to find possible learning effects of the on-line guidance.

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Model of Learner-Centered Computer-Mediated Interaction for Collaborative Distance Learning

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Abstract

Interaction research in distance education has focused mostly on learner-teacher interaction in a learning environment based on a behaviorist curriculum. This presentation focuses on factors contributing to learner-learner interaction in a distance learning course based on learner-centered and collaborative instructional design. The proposed model, which resulted from research on patterns of learner interaction in both synchronous and asynchronous computer-mediated communication modes, examines factors contributing to interaction in the areas of learner characteristics, technology attributes, and learning activities.

Introduction

Interaction research provides important information on student behaviors in distance learning environments to educators, researchers, and instructional designers. The current state of interaction research has focused mostly on the quantitative results of inter-connected messages in computer-mediated communication (CMC) conferences. Contributing factors to interaction such as theoretical principles of course design and learning contexts are largely ignored. While various virtual learning environments and course management systems are being introduced to the distance learning community, it is easy to loose sight on the pedagogical application of the learning systems. Teachers are rushed to learn various state-of-art instructional technologies but not given instructional examples or time to develop well-designed instructional materials for conducting distance learning courses. The issues faced by the educators are similar to that of a novice pilot being rushed to drive a commercial airplane without going through appropriate training via flight simulation. More research on how these systems can enhance student learning and examples of best practices on instructional design in various disciplines are needed for the success of distance education. As interaction has been identified as the key to the success of online learning by researchers (Gunawardena et al., 1997), this study examines patterns of online interaction and the types of instructional design that would enhance online interaction via both synchronous and asynchronous communication.

Learner-centered computer-mediated interaction in this study is defined as reciprocal communication among participants of computer-mediated learning environments that emphasizes learner developments in cognition, motivation, and social advancement for the purpose of knowledge construction and community building. Two theoretical principles that are highly relevant to such interaction are constructivism and learner-centered principles (LCPs). A constructivist distance learning environment places emphases on knowledge construction through interaction with the physical environment and through the appropriation of culturally relevant activities. In other words, knowledge is co-constructed with peers or experts and through the immersion in a social context (Bonk & Cunningham, 1998). The Learner-Centered Principles were developed by the American Psychological Association (APA, 1997) as a framework for the new educational approaches that stress the integration of the needs, skills, interests, and backgrounds of the students into the curriculum planing. The following section on literature review examines the connection between these principles and interaction.

Literature Review

Interaction is often emphasized in different contexts for different purposes, such as construction of knowledge (Gunawardena et al., 1997), and student satisfaction (Hackman and Walker, 1990). Moore (1989) contributed to the discussion of interaction by providing an important framework of three types of interaction: learner-content, learner-instructor, and learner-learner interaction. Moore pointed out that learner-content interaction is a "defining characteristics of education." As a result of learner-content interaction, learners achieve intellectual growth or changes in perspectives. The second type, learner-instructor interaction, highlights the important role of instructors. In addition to defini[illegible]he learning objectives, activities, and materials, distance instructors are also responsible for revising teaching methods and providing evaluation as their students progress in the process of learning. The third type, learner-learner interaction, takes place between learner and other learners in real-time or delayed time and is not restricted to the presence of the instructor. This "inter-learner interaction" can foster learning through student collaboration and knowledge sharing. Although the strategies used to increase learner-learner interaction vary according to the characteristics and backgrounds of the learners, learner-learner interaction can significantly encourage the development of student expertise in different subject areas and promote community building.

Hillman et al. (1994) added a fourth component on learner-interface interaction to the literature discussion. They defined learner-interface interaction as "a process of manipulating tools to accomplish a task" (p. 34). They stressed the importance of learner-interface interaction because the "learner must interact with the technological medium in order to interact with the content, instructor, or other learners" (p. 33). The learner must be empowered to profess the necessary skills to use the communication tools and feel comfortable with the learning environment. Good interface design can enhance interactivity and minimize technological barriers to online learning.

These definitions also highlight the importance of the interrelationship among learners, content, and technology. In the design of a learner-centered distance learning course, it is important to include the four types of interaction in the design. Furthermore, learner-centered principles also provide "an essential framework to be incorporated in new designs for curriculum and instruction, and assessment systems for evaluating educational goal attainments" (American Psychological Association, 1997, p. 1). LCPs consists of the following areas of learning: cognitive and metacognitive factors, motivational and affective factors, developmental and social factors, and individual differences.

As pointed out by Wagner and McCombs (1995), these principles emerged from the following considerations:

- Learners operate holistically as a function of intellectual, emotional, social and physical characteristics.
- The learner's behavior is based on his or her perceptions and evaluations of situations and events from a self-orientation that interprets meaning and value relevant to personal goals and interests.
- The learner's development across all domains of functioning is never static and unchanging, but is a dynamic growth process that serves inherent needs for mastery, control and belonging. (p. 34)

In the context of distance education, the infusion of LCPs into the design of learning systems and instructional activities has provided enhanced opportunities for educators to improve teaching/learning activities. Traditionally, teachers decide what the learners need to know by devising the objectives, instruction, procedures, curriculum, materials, and evaluation. Recently, the increased discussions on learner-centered education have led more educators to recognize the values of empowering the students to take control of their learning. The design of the curriculum takes into consideration students' background and prior knowledge in the subject matter.

The LCPs provide a solid framework for the new educational approaches. However, the actual implementation is subject to individual interpretation and still requires much effort for educators to come up with feasible strategies. Fortunately, constructivism that originates from philosophical and educational theories has provided viable strategies for teaching and learning. Jonassen et al. (1995), long-time advocates of constructivism for CMC systems in distance education, argued:

> Constructivist principles provide a set of guiding principles to help designers and teachers create learner-centered, collaborative environments that support reflective and experiential processes. Students and instructors can then build meaning, understanding, and relevant practice together and go far beyond the mere movement of information from instructors' minds to students' notebooks. (p. 8)

According to Jonassen et al. (1995), the four constructivist attributes for building learning systems are context, construction, collaboration, and conversation. *Context* refers to the "real world" scenario in which learners can carry out learning tasks as close to the real world as possible. Learning tasks should have real-world implications so that learners can connect what they learn in the classroom with the real world. *Construction* concerns knowledge that is built on the "active process of articulation and reflection within a context" (Jonassen, 1995, p. 8). Learners acquire knowledge better when they can link their own experience with the learning materials and make sense of them. Learners master a subject better in the process of constructing knowledge. *Collaboration* helps learners to develop, test, and evaluate their ideas with peers. Learners are exposed to multiple perspectives in a problem-solving case and then come to a self-selected conclusion on a particular issue. This is an important part of the learning process. *Conversation* is engaged by group members for purposes such as planning, collaboration, and meaning making. It is especially important for distance learning because most communication is done through online exchanges. A successful conversation will lead to good preparations for and completion of online tasks (Jonassen et al., 1995).

Distance learning courses that are based on the LCPs and constructivism have demonstrated enhanced interaction and academic achievements. The next section reviews the process of implementing the theoretical principles into the instructional design of a distance learning course.

Background

The course for this research is an upper level undergraduate course titled "Theories and Applications of Computer-Mediated Communication Systems" offered at the University of Hawaii. The main objective of the course is to enrich the understanding of CMC systems through discussions and effective use of various CMC systems. The course design is based on the following theoretical principles:

Principle 1: Learner-centered instructional design: The course design considers student development, especially in the following areas: cognitive, meta-cognitive, motivational, affective, social, and individual differences. Students learn to monitor their own progress, manage the course content, and develop expertise in a sub-domain of CMC study. Specific examples of learner-centered instructional activities include the use of student reflection journals for the purpose of metacognition and student-centered discussion for motivating them to take control of the subject matter.

Principle 2: Constructivist activities: The emphasis is placed on student acquisition of knowledge via active involvement with the curriculum rather than via imitation or memorization of facts or course content. Specific instructional activities based on the constructivist principles include synchronous and asynchronous discussions for co-construction of knowledge and project-based learning for real-world application.

Principle 3: Small group cooperative learning: Students collaborate on tasks in small groups to accomplish a set of predefined learning objectives and to advance their knowledge in a domain. Emphases are placed on community building and knowledge sharing. They equally share the responsibilities of the assigned tasks and semester projects. At the end of each term, they demonstrate the ability to accomplish the task on an individual base.

The course for this study was conducted through a number of text-based (WebCT chat and ICQ), audio-video conferencing (CU-Seeme & Netscape Cooltalk), and enhanced virtual systems (The Palace & Active World). Students took turns to moderate seminars in three-member small groups each week. They followed the guidelines of Student-Centered Discussions (SCD) (Chou, 1999; Shooop, 1997) to participate in the online seminars. In general, students participated each online seminar by following the SCD principles such as respecting each other, generating ideas, listening tentatively, and referencing each other during conversation. Whereas, student moderators kept the discussion alive by observing rules such as greeting participants, devising warm-up activities, making an opening statement, using a step-by-step discussion process, asking questions, scripting the discussion, and preparing concluding remarks (Chou, 1999), Detailed description of instructional design, course syllabus, and the CMC systems employed are described in the research by Chou (2001a, 2001b)

Research Design and Methods

This study examines interaction patterns at both interpersonal and system levels in a learner-centered distance collaborative learning environment. The research focuses on factors that affect interaction from three areas: learning activities, technology attributes, and learner characteristics. At the system level, student perceptions of both synchronous and asynchronous CMC systems and the relationship with interaction are investigated. At the interpersonal level, patterns of learner-learner interaction over both communication modes are compared and contrasted. Furthermore, the overall effects of various theoretical-based instructional activities on learner interaction are also scrutinized. The research methods include content analysis, formative and summative evaluation of the instructional activities, and technologies employed in a distance-learning course. The data for content analysis are based on conference transcripts from both synchronous and asynchronous communication. Formative data are based on student reflection journals, instructor's log, and observers' logs. Four observers were invited to observe the class on a weekly basis. They submitted a weekly log to the instructor to suggest improvement on the instructional design and activities for this class. The summative data are collected from the following student surveys: student background, course evaluation, CMC-skill assessment, student perceptions of communication characteristics of technology, group cohesiveness and performance. Detailed descriptions of these surveys can be found in Chou's dissertation work (2001b).

Both synchronous and asynchronous seminars were conducted on a weekly basis. In the synchronous seminar, students were responsible to take turns in moderating small group discussions. In the asynchronous seminar, students collaborated in building a knowledge base by sharing and exchanging constructive views on a topic related to CMC systems. In addition to the weekly discussion, the semester-long projects also required the students to collaborate in small groups via various CMC systems.

Bale's (1950) Interaction Process Analysis (IPA) was adapted as the basis for content analysis to describe the patterns of student interaction in small groups via both synchronous and asynchronous networks. IPA was originally developed to study small group interaction in two main areas: socioemotional -oriented and task-oriented interaction.

Research questions are divided into the following three main categories:

A. Technology Attributes
  QA1: What are the technological factors that affect student interaction?
B. Learning Activities
  Synchronous vs. Asynchronous discussions
    QB1: Is there a significant difference in the social-emotional contents and task-oriented contents between synchronous and asynchronous communication?
  Conference Moderation
    QB2: Moderator vs. Participants: How can a conference moderator help to facilitate online discussions?
  Small Group Collaboration
    QB3: What are the student perceptions of small group collaborative activities?
C. Learner Characteristics
  Prior Computer experience
    QC1: Is learner's experience with computer correlated with total number of messages submitted?
  Gender
    QC2: Is there a significant difference in the SE-oriented vs. task-oriented contents between female and male participants?

Analysis and Discussion

Technology Attributes

Students rated each CMC system on the following communication characteristics: social presence, communication effectiveness, and communication interface. Of all systems tested, WebCT chat received the highest rating and the Palace came in second place. This is an indication that students valued reliable and smooth connection for communication. WebCT chat turned out to be the most reliable and straightforward CMC systems used. In addition, the add-on affective components (wearable-avatars, voice-activation, bubble messages, etc.) in the Palace actually made the conversation more realistic. Students demonstrated enjoyment in using the avatars to express themselves during the online conversations.

Positive technological attributes can enhance interaction and negative technological attributes can hinder interaction. Table 1 is a summary of various technological factors that affect interaction.

Table 1. Positive and Negative Technological Attributes Affecting the Degree of Interaction

Positive Features	Negative Features
A. System performance	
Fast loading, low bandwidth	Bandwidth intensive
Transcript recording	Non-recordable conversation
Good audio/video quality	Poor audio/video quality
Cross-platform compatibility	Platform-specific
B. Interface design	
User-friendly navigation tools	Nontransparent or no navigation tools
Learner centered (e.g., customizable, flexible, and scalable interface)	Program controlled (e.g., fixed and un-customizable interface)
Wearable avatars with a variety of selections	Fixed-type avatars with stereotypical selections
Low levels of distraction (e.g., good visualization of screen icons)	High-levels of distraction (e.g., lack of organization of screen icons)
Status indication (e.g., occupied, off-line, online, etc.)	Lack of status indication
Accessible to users with disabilities (e.g., Bobby-approved, text-to-speech option)	Not accessible to users with disabilities
C. Communication characteristics	
High degree of social presence	Low degree of social presence
Effective for communication at interpersonal level	Ineffective for communication at interpersonal level
Effective for communication at system level (e.g., fast message exchanges)	Ineffective for communication at system level (e.g., delayed message exchanges)
High degree of expressiveness (e.g., mood indicators)	Low degree of expressiveness
Affective communication components (e.g., optional toolbox for emoticons, props for avatars, etc)	Impersonal communication components (e.g., command-line oriented communication)
Division of public vs. private space (e.g., breakout sessions for small groups)	Lack of division of meeting rooms

Based on the observation by the instructor and evaluators, student adaptation to technology can be summarized in four stages:

- The WOW stage: At the initial phase, students were fascinated with the potential of technology and amazed at what CMC systems could have accomplished.
- The FUN stage: At the second phase, students actually used the systems for simple tasks and derived a great deal of pleasure in the hands-on experience.
- The OH-OH stage: This was the frustrating stage when more complex tasks were given and their skills had not developed enough to handle these tasks.
- The "Back-to-Normal" stage: Students either became more competent in the use of technology or became comfortable with dealing with technical difficulties. They internalized their anxiety and accepted that technical glitches were inevitable in the learning process.

Learning Activities

a. Synchronous vs. asynchronous discussion

The two main categories in Bale's IPA are social-emotional oriented interaction and task-oriented interaction. The multiple regression analysis shows that both variables significantly predict the interaction patterns in both communication modes, $F(2, 116) = 85.7$, $p < .0001$ (Table 2). The mean sentence per person in synchronous mode is 26.31 sentences and 51 sentences in asynchronous mode. Because $R = .77$ and $R^2 = 0.6$, 60% of the variance is accounted for by these independent variables. The analysis shows that there is a significantly higher amount of SE-oriented interaction in synchronous discussions and a significantly higher volume of task-oriented interaction in asynchronous discussions.

Table 2: Multiple Regression Analysis Predicting Interaction in Synchronous Versus Asynchronous Discussions

	Syn. Mean	*Syn. SD*	*Asyn.Mean*	*Asyn. SD*	*F*	
SE	8.66	8.12	4.26	4.72	-7.46	***
TASK	17.65	15.53	46.74	19.11	12.21	***
totals	26.31	22.01	51.00	20.76	5.85	***

***$P < .0001$

In the synchronous communication mode, there was more spontaneous communication going back and forth. The communication processes between asking and answering questions are more equally distributed in synchronous communication, whereas in asynchronous communication, students tended to volunteer to give more information than to ask questions.

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The synchronous communication mode also made it easier to provide immediate feedback to information seekers. Some students were actively engaged in discussions while other students waited until they were asked to say something. The researcher observed that there was more equal participation in the discussions in three-member small groups than in large groups. In addition, in synchronous mode, participants asked more personal questions and revealed more about their frustration or need for help with less hesitation. Personal questions such as one's occupation, schooling history, and background of technical training were included more often in synchronous discussions.

b. Conference moderation

Students took turns moderating small group discussions in the weekly synchronous seminars. Every group was responsible for hosting one online seminar in the semester. Because there were thee members in each group, the seminar was usually divided into three small groups so that each member of the host group could moderate one group in the online seminar. The moderator's action is highly correlated with the performance of the conference participants. According to Table 3, when a moderator sent out more task-oriented content, the participants also responded with more task-oriented messages, $F(1, 163) = 36.58$, $p < .0001$. Likewise, when a moderator sent out more SE-oriented content, the participants responded with messages of the same nature, $F(1, 163) = 11.91$, $p < .001$. In addition, the total number of messages sent by the moderators also contributed positively to the total number of messages sent by the participants, $F(1, 163) = 28.85$, $p < .0001$. Overall, the moderator's functions are vital to the information exchanges in a small group discussion. The comparison of the mean sentences between moderator and participant indicates that in order to encourage active discussion, the moderator usually sent out two or three times more sentences than the participant.

Table 3: One-Way ANOVA Between the Mean Sentences Sent by Moderators and Participants

	Moderators	*Participants*	*F*	
SE Mean	9.05	3.5	11.91	**
Task Mean	24.15	6.29	36.58	***
Total Mean	33.19	9.78	28.85	***

***$p < .0001$, **$p < .001$

c. Small group collaboration

Two forms of collaboration took place in small groups: synchronous seminar and project preparations. In addition to working together to host a successful synchronous seminar, members of a small group also met several times in private throughout the semester to prepare for seminar moderation and case study. Students were asked to complete the questionnaires on group cohesiveness, individual commitment, and individual performance at the end of the term. The highest score one member of a group could get was 40 points. In Table 4, the mean score of each group is listed.

Table 4 Group Performance Evaluation and Group Cohesiveness Score

Groups (n = 3)	Cohesiveness		Perceived quality of group performance	
	Mean	SD	Mean	SD
GROUP 1	39.67	0.82	5.98	0.86
GROUP 2	37.5	3.89	6.02	1.16
GROUP 3	38.5	2.07	5.94	0.97
GROUP 4	32.5	10.61	3.76	1.63
GROUP 5	37.0	4.08	5.53	1.18

The correlation between the perceived quality of group performance and group cohesiveness is significantly high, $r = .95$, $p = .01$. Group members who rated their actions highly cohesive also deemed their performance high. However, the correlation between perceived quality of group performance and individual commitment is low, $r = -.12$, $p = .29$. Individuals who were committed to their work did not necessarily consider group performance quality high (see Table 5). In some instances, members of a group might work harder when they foresaw that the quality of group performance would not be up to standards. Putting students in small groups and assigning collaborative tasks to each group does not always guarantee a successful learning experience. The summary section concludes a number of factors affecting online interaction..

Table 5 Mean Score of Individual Commitment and Perceived Quality of Group Performance

Groups (n = 3)	Perceived quality of group performance	Individual Commitment
GROUP 1	5.98	5.83
GROUP 2	6.02	6.64
GROUP 3	5.94	5.50
GROUP 4	3.76	6.13
GROUP 5	5.53	6.00

Learner Characteristics

Due to insufficient data and small sample selection, no significant correlation was found between total messages sent by each participant and their previous computer experience. In terms of gender differences, significant differences were found in synchronous mode in both SE-oriented and task-oriented interaction. In general, female participants sent out more sentences than the male participants in both synchronous and asynchronous communication modes; the female mean sentences are higher. Nevertheless, female participants sent out significantly higher number of messages in both SE-oriented and task-oriented areas. Overall, female participants consistently sent more SE-oriented messages in both communication modes.

Summary

Interaction Factors

The main conclusion drawn from this study is that the design of learner-centered online activities and the selections of appropriate technologies do contribute to different patterns of interaction. The research findings are summarized as follows:

A. Learning activities: Constructivist-based instructional activities such as student-moderated discussion and small group cooperative learning are conducive to interaction and learning. Specific findings are listed as below:

a. The appropriate use of synchronous online seminar can enhance interpersonal relationship. In general, students submit a higher percentage of task-oriented messages than social-emotional oriented messages in both asynchronous and synchronous communication modes. Nevertheless, there is a higher percentage of social-emotional interactions in synchronous mode than in asynchronous mode.

b. Asynchronous peer review provides the opportunity for collaboration on building knowledge bases and information sharing.

c. Interestingly, there was more one-way communication in asynchronous mode. In asynchronous mode, students seemed to be more interested in expressing opinions than challenging each others' views; whereas in synchronous mode, there were more questions and answers. Students were more engaging in the synchronous discussions. There was a stronger sense of immediacy to respond to peers' questions in synchronous mode than in asynchronous mode.

d. Student-moderated conference based on the SCD Model allows learners to take initiatives in their learning and be efficient in communication via various CMC systems.

e. Forming small groups for online seminars or group projects helped to reduce the initial disorientation and confusions of online learners.

B. Technology attributes: Discussion on technology attributes focuses on the mode of communication systems and the communication characteristics such as social presence, communication effectiveness, and communication effectiveness.

a. Communication systems: the selections of synchronous or asynchronous technologies contributed to the different interaction patterns. Students tended to spend much more time in task-oriented discussions in asynchronous mode. When online tasks were clearly defined and students passed the initial "get-to-know-each-other" stage, students were inclined to spend less time in SE-oriented interactions in both communication modes. Nevertheless, learners consistently spent more time in SE-oriented interaction in synchronous mode than in asynchronous mode.

b. Communication characteristics: Student ratings of a CMC system increased as the frequency of uses increased. Student perceptions of the communication characteristics of technologies might affect their initial interaction online. Time played an important role in student adoption of new technology. Usually after the first two or three weeks, students were able to ignore some of the "obstacles" of a system and concentrated on the task at hand.

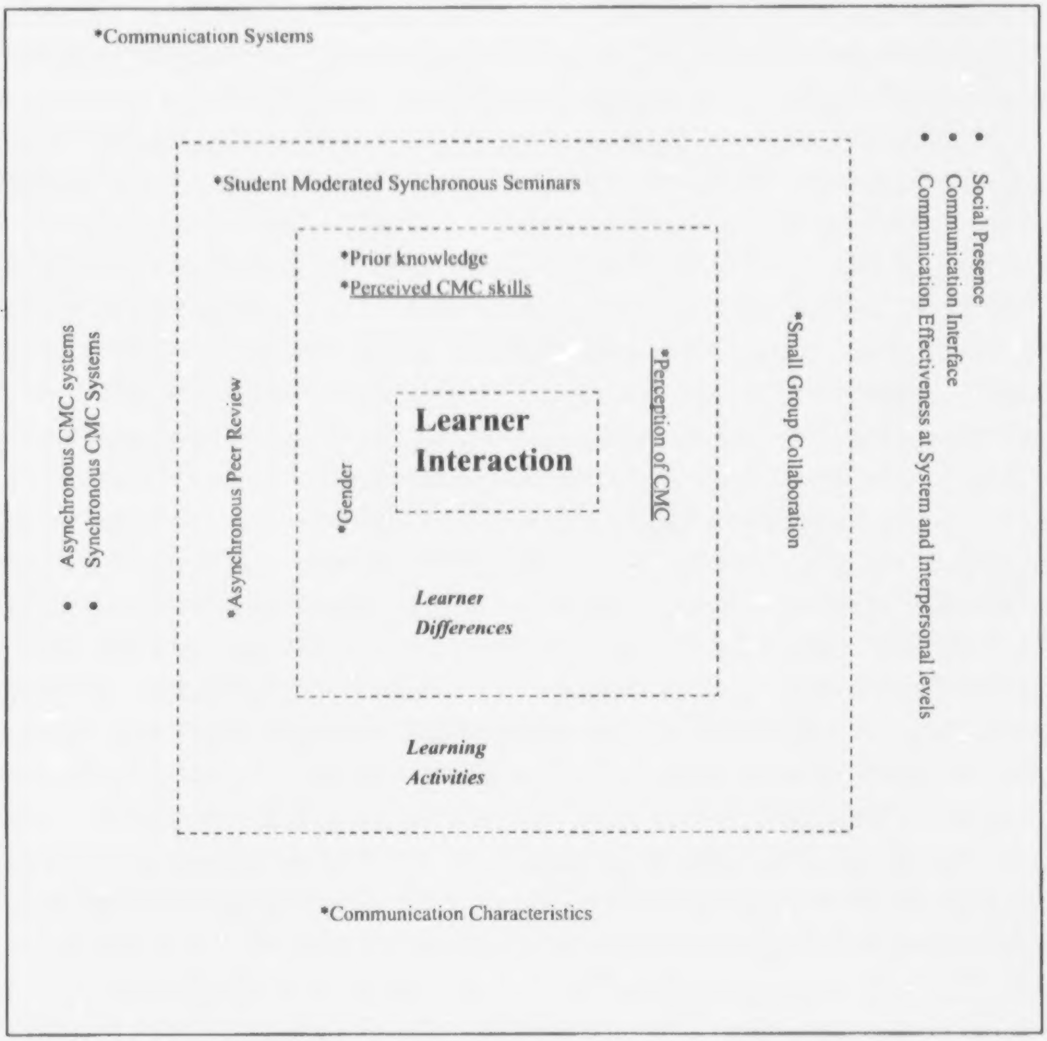
c. Learner characteristics: Gender difference affects how students interact online. Female students contributed more to SE-oriented interaction than the male students in both communication modes. In addition, prior knowledge in a subject matter and computer experience contributed to the different interaction patterns in the individuals at the beginning stage. After the first two weeks, the difference was hardly noticeable.

As the result of the research, a model of Learner-Centered Computer-Mediated Interaction for Collaborative Distance Learning is proposed to explain factors that could affect interaction as shown in Figure 1.

Conclusions

Research in distance education covers a wide spectrum of issues. Although interaction is not the only key to successful distance education, this factor is vital to the progress of learners, teachers, and the school as a whole. As Gunawardena et al. (1997) has boldly put it: "No interaction, no education." This research emphasizes the importance of interaction research by providing supporting evidence in activity design, technology employed, and learner differences. This study advocates the integration of learner-centered instructional design and constructivism into the curriculum. The researcher hopes to break the myth that synchronous communication is impossible to manage. On the contrary, as shown in this study, the appropriate incorporation of synchronous activities can enhance learning interests and interpersonal relationship. Although there is no lack of research in distance education since the 1980s, there is a need for more research on emerging technology employed in distance education because the implications and applications also affect educational policy and management. This study is a small contribution to the understanding of the ever-changing technological ecology of distance education.

Figure 1: Model of Learner-Centered Computer-Mediated Interaction for Collaborative Learning


•Communication Systems
• Asynchronous CMC systems
• Synchronous CMC Systems
• Social Presence
• Communication Interface
• Communication Effectiveness at System and Interpersonal levels
•Student Moderated Synchronous Seminars
•Asynchronous Peer Review
•Small Group Collaboration
•Prior knowledge
•Perceived CMC skills
•Gender
•Perception of CMC
Learner Interaction
Learner Differences
Learning Activities
•Communication Characteristics

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Web Enhanced Learning and Student Awareness of Strategy Use

Jane Crozier

Abstract

This qualitative study examined the awareness of strategy use and justification of that use of gifted undergraduate students as they researched, utilized resources, and evaluated finalist for a global understanding and peace award. The participants in the informal learning environment utilized a web-based learning environment. Their homepage was developed in WebCT and allowed them to access to informational resources, conduct online chats, and write reflective journals. The findings focused on the student awareness of their strategy use and their online learning community experience.

Introduction

An increasing number of universities and K-12 school systems are using some type of web-based support for learning (Mandiach & Cline, 2000). Mandiach and Cline (2000) argue that despite the enthusiasm of some educational institutions, practical and curricular problems related to the integration of web-based learning environments persist. These environments range from low-level integration where a homepage contains links to related information; to mid-level integration, where a homepage contains informational links, asynchronous and/or synchronous communication connections in the form of chat sessions or a bulletin board, and course handouts; to a high-level integration, where the entire course is delivered via the homepage including lectures, homework, all communications, testing, and student grades (Miller & Miller, 2000).

Researchers have just begun to scratch the surface of the usefulness of the range of different levels of web-based learning environments (Gunawardena & Zittle, 1997; Miller & Miller, 2000; Palloff & Pratt, 1999). The research highlighted the online learning communities involved in various levels of web-based environments and learner characteristics that enable students to successfully interact and learn using these environments. These elements were identified through exploration of either reflection or collaboration, and from the perspective of the teacher and/or student.

Purpose

This study continues the research into web-based learning by examining a mid-level web-based learning environment as a support for an informal learning experience. The informal learning situation was a group of undergraduate students, that were Fellows in the Honors program, who served as the selection committee for the finalists of a global awareness and peace award. The committee members needed to determine the award criteria, research and learn about the backgrounds and attributes of each nominee, and evaluate each nominee based on the criteria for the award. There were a variety of strategies the students would utilize in order to develop criteria, research nominees, and evaluate nominee attributes. The learning aspect explored was the role the web-based environment had in supporting student awareness of strategy use.

Online reflection and collaboration activities to identify strategy were used and the reasoning behind that use, from the student perspective. In addition, perceptions of the student's online experience were sought. The original research question addressed in this study was, "How does a web enhanced learning environment effect the nomination process?"

Research Literature

Awareness of strategy use

Researchers in the field of psychology consider "awareness of strategy use" as part of an individual's metacognitive abilities. Bjorklund (1995) and Sternberg (1990) identify these abilities as an individual's knowledge and regulation of cognitive processes. The knowledge of an individual's cognitive processes or strategies involves knowing the proper time to use strategies and the reasoning behind their use. The regulation of cognitive processes or strategy use involves planning strategy use and evaluation of the result of the strategy usage, although mentioned here as a definition, regulation is not a focus in this study.

The research on strategy use and the reasoning behind that usage, the focus of exploration for this paper; involves strategy use in problem solving (Royer, et al, 1993) and among gifted students (Carr, et al, 1995). Strategy usage has been easy for students to identify, however the reasoning behind strategy use is more difficult for individuals to identify. The findings dealing with knowing when to use a strategy have indicated that it is fairly easy for adults to identify strategies they have used; however younger learners cannot always identify a strategy by name (1995). In both cases, discussing their reasons for strategy use was much more difficult, if not impossible.

Online student reflection

The research conducted involves student reflection activities, and usually revolves around student impressions of learning and working in an online learning community (Sherry, et al, 1998; Gunawardena & Zittle, 1997). However, one study of particular interest was that of Guzdial and Turns (2000); where they examined student reflective practice in an online community as the students collaborated on projects in an online engineering course at the University of Michigan. According to the findings, in order for the students to successfully contribute to their class, they had to reflect on the bulletin board discussion threads and determine whether a new or alternative idea should be contributed to the concept thread and how their response would be perceived. These practices assisted in student contribution to course discussion threads and, the researchers noted, in turn, enhanced student learning.

Online student collaboration

The research involving web-based learning support of student collaboration focused on providing students with immediate access to their peers and to informational resources on the Internet (Palloff & Pratt, 1999; Sherry, et al, 1998). Through collaboration, many students form online learning communities within the bounds of the course or project. Palloff and Pratt (1999) emphasize that these communities have a great influence on the success of the class; in fact, these researchers suggest that if the community is unsuccessful or does not exist then no learning occurs.

The strength of the collaboration is key to the success of the community and is dependent upon the student's comfort level as a member of the community. Sherry, et al (1998) discussed that participants in their study had stronger communities when the members had a high comfort level while working in the online environment. An element that enhances a member's feeling of comfort is what Gunawardena and Zittle (1997) called a "sense of presence." According to these researchers, this sense of presence indicates that the member feels a strong connection to the online community. In addition, it has been identified as a key factor in successful online learning experiences.

Method

Participants

The participants involved in this study were nine Honors Fellowship undergraduate students at a public university. Students who received a fellowship are viewed as gifted. These Honors Fellows served as members of a selection committee responsible for selecting the finalists for an annual global understanding and peace award. One third of the committee had participated the previous year. The names used in the study were pseudonyms selected by the participants. There were two teams. The advisor to the this student committee was also the researcher.

Study Design

This study took place in the informal educational setting of the award selection committee for approximately two and a half months. The participants worked individually to research their nominee (included individuals and nonprofit organizations involved with issues related to global understanding and peace initiatives) and in teams to support each other's efforts. The first two committee meetings were designed to orient the students to research resources, establish evaluation criteria for the nominees, and allow the students to select their nominee.

In the following month, the teams met weekly to discuss member research progress and evaluation issues. These weekly meetings were held in the team chat rooms. The final team meeting was held face-to-face. Each team member introduced his/her nominee and answered questions posed by other team members. At the end of the meeting, the team members selected one or two nominees to submit to the full committee as finalists. The team members who nominated the team finalists incorporated the feedback from other team members into a one page composite listing of the nominee's background and attributes for submission to the full committee. The full committee reconvened after the final team meetings and nominated the finalists.

During the final two meetings, in the first full committee meeting, each team introduced their nominee to the group, in a similar manner as they did during the final weekly team meeting. The full committee then voted on the nominees from the teams and selected all the nominees submitted, six in all. The finalist composites submitted to the full committee were expanded into nomination documents. These documents detailed the nominee's background, affiliated organization, and criteria based attributes; and were then sent to the governing board.

Homepage Design

The committee web page was developed in WebCT (an Internet based course support system which supports asynchronous and synchronous communication such as Chats and bulletin boards, as well as student records, faculty lectures and notes via audio and/or video). The homepage provided the group with secure access to: 1) Weekly meeting schedules and updates, 2) team chat rooms, 3) reflective journals via bulletin board, 4) forms to support research, and 5) links to research databases. These resources provided a convenient and effective means for feedback among the team members and the advisor. After the weekly chat meetings, students were asked to reflect on the process they used and their online experience, in their individual online journals (shared only with the advisor, not the other students). The students used forms on the Homepage that served as guidelines for recording sources. The students provided research database links that grew in number as they located more sources of information. The links were made available to all committee members in order to help those having problems locating resources.

Data Collection

The study's data collection resources were triangulated to trace student strategy use, depict student awareness of strategy use and its justification, as well as provide confirmation of findings. This triangulation of data resources was utilized to provide greater validation to the study (Patton, 1990).

- Weekly Team Chat Session Discourse: The chat session discourse was recorded and reviewed in search of evidence of criteria and evaluation strategy discussions. The reflective journals were included as a main source of data related to student awareness of evaluative strategy use.
- Student Reflective Journals: Each week, the students were asked to respond to a few brief questions and incorporate their own thoughts and ideas, about the process, and their research, into their own reflective journal.
- Semi-formal Interviews: The interviews of team leaders/facilitators were conducted half way through the project. These individuals were selected because they facilitated the chat discussions and their role focused on review of team progress. They presented opportunities for obtaining data related to student awareness (Patton, 1990). Most of the student questions focused on the criteria selection process, research, and the online experience.
- Participant Observer Fieldnotes: Since the researcher (myself) was also the advisor to the group, participant observer fieldnotes were used. These notes were summaries of events during the face-to-face meetings.
- Student Artifacts: The student artifacts or final nominee documents were used to review the synthesis of the team's work and the progression of evaluative strategy use.

Data Analysis

The qualitative case study method was used (Glaser, 1995; Merriam, 1997) to analyze the data collected in this study. The case study method incorporates constant comparison for the analysis. During the analysis, the researcher reviewed the data, identified patterns, determined categories, and identified overriding themes. The student reflections, chat discourse, and final documents were compared to identify repetitive themes related to awareness of strategy use and online learning. The field notes and artifacts were used to verify findings. The credibility of the study analysis was enhanced through an exhaustive search for negative cases found in the themes. According to Merriam (1998), a negative case is one that is the extreme opposite of the patterns or trends discovered during analysis. These cases were sought to extend the definition of the rule of the pattern, as in participant awareness of strategy use or participant experience as an online learner (Patton, 1990; Merriam, 1998).

Key Findings

The students began their discussion to establish the criteria used in evaluating nominee goals and accomplishments; the group discussion required an additional group meeting in order to determine the final criteria. After this first meeting, the participants selected their nominee (there were fifteen nominees and nine students, so six students selected two) and began their research. At the end of the second meeting, the criteria was established. The students developed a list of five criteria: Awareness, Benevolence, Commitment, Diplomacy, and Influence. The presence of the criteria served as a foundation for the students and was mentioned periodically during team meetings as reference points from which to gauge the information they were reviewing. The criteria guided their research, discussions, and decision-making. The responses to the interview questions, guided reflection, and chat discussions provided a comprehensive picture of the student strategy use and their online experience. Two key questions asked were, "What steps did you take to determine the criteria?" and "Why did you make your selection?"

Awareness of Strategy Use

The students were able to identify the strategies they used to establish the criteria, such as brainstorming, adaptation, compare and contrast, and simplification. However, most did not adequately discuss their reasons justifying their choices. One student, Madi, from Team A, demonstrated this when she discussed her strategy selection during her participation in the first round of criteria development:

> I just basically brainstormed ... And then in my group, Don and Jan, they had really specific things, like "have an extended period of service" ... – mine are a little vague so I adapted mine to the more specific things that they had.

Madi's awareness of her use of the brainstorming and adaptation strategies were present however her reasoning for discarding her original criteria list and adopting the list of her teammates seemed weak. Madi adopted the new list, citing that it was more specific than her list, but did not expand on why she found this attribute preferable. This awareness of strategy use and lack of reasoning was apparent in the reflections of most of the participants. The ability has been noted in gifted students by Carr, et al (1995); their findings indicated that gifted students more so than average students possess specific strategy knowledge or the metacognitive knowledge about when and where to use a strategy with fewer of the students knowing why they used a strategy.

The students in this study, indicated that they knew when and where to use a strategy, however, only one expressed exactly why she used a specific strategy. Another student, able to identify the strategies she used, was also able to discuss her reason for using the strategy. This unusual illumination occurred with one participant, a case which further defines the strategy usage theme to allow for some rare occasions when gifted students are able to justify their use of a strategy. Radison, from Team B, commented on her own strategy use and reasoning, when she discussed the hour of debate that ensued prior to the acceptance of the final criteria list. This debate was a war of words rather than meaning; the paragraph length descriptions of each attribute was eventually reduced to the five general terms representing global understanding and peace at Radison's Team's prompting (The five criteria for global understanding and peace were: Awareness, Benevolence, Commitment, Diplomacy, and Influence). Radison wrote in her journal:

> We came up with five words that seemed to cover the overall theme we had been trying to get at in all the previous work. I think simplifying is often the most overlooked step in processes such as these. Sometimes it's hard to take ideas off the list because it feels like we're moving backwards.

Radison recognized that the strategy the group was using to finalize the criteria (refining the phrases, word by word) was not working and suggested another way of accomplishing the task. This way was accepted almost immediately.

Online Learners

Online community:

The chat sessions, participant observer field notes of face-to-face meetings, and interview responses from the two team leaders relayed information regarding student roles and impressions of the online chat meetings. The patterns that emerged depicted themes of the nature of online collaboration that focused on member support and interaction in the online community. Each member had a role, i.e. facilitator, support member, or advisor; most of these roles were identified in Palloff's and Pratt's work (1999). In a supportive function, team members voluntarily offered information resources, research tactics, and emotional support for those frustrated with either an over abundance or lack of informational resources. These aforementioned practices demonstrate a camaraderie among team members that appears to have strengthened throughout the committee's tenure. The teammates joked with and teased each other.

However, the establishment of the online community could not be solely attributed to the participants' involvement in the chat sessions. Since many of the students knew each other prior to their involvement in the committee, due to their honors fellowship affiliation; the camaraderie among Team B community members, while strengthened by the online interaction, was also a product of the prior affiliation and the face-to-face meetings (Palloff & Pratt, 1999; Gunawardena & Zittle, 1997).

The students preferred interaction among their peers, indicating a greater satisfaction and comfort level, than from their online interactions. While the facilitated discussions and online chats provided team members with a convenient opportunity to give and obtain the additional skills they needed to access additional information about their nominees and support better decision making; the chat environment didn't offer the personal interaction the team members were accustomed to and preferred. The students stated that they felt the online meetings were convenient and productive; however, since they were on the same campus, their preference was for face-to-face meetings (Sherry, Fulford, and Zhang (1998). The team mentioned that they would work in the online environment again, but only out of convenience (1998). Overall, the team members impressions of their online experiences were productive and facilitated their research, but less satisfying than their face-to-face interactions.

Lack of social presence:

The students indicated that the online experience just wasn't the same as meeting in person. They exhibited some resistance to the use of online means of communication by requesting that they have another face-to-face meeting instead of a final chat session. This resistance could have hindered their online experience, but was not the only deterrent to their online experience. The students mentioned that technical problems, such as delays in response time and disconnections, made for a less than optimal experience; and due to typing delays, the chats were sometimes difficult to contribute to and follow.

Online behavior:

As mentioned in the Online Community section, much of the online behavior observed supported past research that identified members of the community assuming and maintaining their roles in the community (Palloff & Pratt, 1999). One role, of particular interest during the team chat sessions, was the that of the chat facilitator. The facilitator was voted in by the team to be the team leader and facilitate the chat meetings. The unexpected online strategies used by the chat facilitator were monitoring and troubleshooting the chat session. These were used to maintain continuity during the discussion and ease any discomfort among chat participants,. This practice moved team members through awkward moments and is illustrated by TLeader, from Team B, after a few minutes of silence and an interruption in the chat:

TLeader:	this may be an awkward silence, so i'll move on. Nimbus, how's your research going?
Nimbus:	Do they focus on promoting peace between certain religions or do they have broader goals of general tolerance/acceptance?

During later reflection she indicated that it was difficult to determine why chat participants stopped interacting (typing).

> Somebody could have been typing, somebody could have been thinking, somebody could have been preparing a response, but nobody really knows so you are just sort of sitting there wondering well should I break the awkward silence.

TLeader monitored and effectively smoothed over the rough spots during the online chat. When she encountered a difficulty or interruption in the communication line, she mentioned it and moved on. This practice seemed to assuage some team members discomfort in the online environment. Madi, chat facilitator for Team A, did not specifically address the silences; she simply moved on quickly through the session. This practice could have affected her team interaction; they did not have a great deal of camaraderie.

Recommendations for Practice

- Online monitoring and troubleshooting strategies of chat facilitators can improve comfort level and promote community during chat sessions. Acknowledging awkward moments, such as silences, inactivity or technical difficulties and quickly move forward may improve comfort level and promote community among group members.
- In the online learning community, to maintain student interest and increase student comfort, create a sense of presence for the students, by the use of humorous emoticons ☺, self-selected avatars, or other methods to improve a student's online experience.
- Guided reflection may encourage student awareness of strategy use for evaluation purposes and online community facilitation.

Conclusion

This study has laid the groundwork for future research in online learning communities through the examination of online strategy use of chat facilitators. The findings here encourage further analysis of successful facilitative strategies for chat sessions in order to provide continuity in communication, enhance member comfort, ensure the productivity of the group, and facilitate the learning process.

In addition, the findings of this study support those of other researchers in the area of metacognition or awareness of strategy use among gifted students. Specifically, the participants in the study were able to identify their strategy use during criteria development and all but one experienced greater difficulty identifying their reasons for using a particular strategy.

Furthermore, the findings support previous research on successful online learning communities, especially in the importance placed on student comfort level and having a sense of presence in the online environment.

Finally, this study offers additional insights on web-based learning, such as facilitation of online communities and reflective practices, leaving the essence of successful web-based learning less of a mystery.

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Authoring Tools and Learning Systems: A Historical Perspective

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Abstract

Authoring tools have evolved over the last decade based on technological and pedagogical innovations, from authoring bounded, program-controlled learning systems such as Computer-Based Instruction (CBI) to authoring unbounded, learner-centered environments such as Web-Based Instruction (WBI). This paper discusses the current and future state of authoring tools and their pedagogical effect on the development of learning systems. It provides a taxonomy of authoring tools and their underlying paradigms; a detailed table that compares and contrasts pedagogical attributes of CBI and WBI; and it discusses two innovative approaches on how future authoring tools can preserve the level of usability and the instructional methods that instructional designers have become familiar with while allowing more powerful and flexible learning systems to be built

What are authoring tools?

Authoring tools are software tools that enable instructional designers, educators, teachers and learners to design interactive multimedia and hypermedia learning environments without the knowledge of programming languages. "The premise behind authoring tools is the absence of a programmer or the ability of designers with little or no programming experience to develop and design instructional applications" (Hedberg & Harper, 1998). For example, multimedia authoring tools facilitate the development of Computer-Based Instruction (CBI) by masking the programming layer, and Web-based authoring tools facilitate the development of Web-Based Instruction (WBI) by masking the HTML scripting layer (Craney, 1996). In essence authoring tools are an accelerated application or simplified form of programming by virtue of their inclusion of pre-programmed elements for the development of interactive multimedia and the deployment of a point and click user interface to activate these elements. Authoring tools however accomplish their tasks using a certain methodology or paradigm that requires a type of heuristic or algorithmic thinking similar to that of programming languages (Siglar, 1999). Some of these paradigms include the scripting metaphor, the card-scripting metaphor, iconic/flow control, hypermedia linkage, the frame metaphor, the cast-score metaphor, the hierarchical object metaphor, and tagging (Kozel, 1997; Siglar, 1999). Table 1 provides a brief explanation of these heuristic paradigms and examples of authoring tools that utilize these paradigms.

Table 1 – Authoring Paradigms

Authoring Paradigm	Explanation of paradigm	Examples of Authoring Tools
Scripting metaphor	Resembles a programming language in that it involves specifying all media elements by filename and interactions by coding	TenCORE Language Authoring System
Card/scripting metaphor	Uses an index-card structure or a book metaphor to link elements	Hypercard, Supercard, HyperStudio, TenCore, Toolbook II
Iconic/flow control	Uses icons to represent interactions and links them sequentially in a flow line that depicts the actual result	CourseBuilder, Authorware, IconAuthor, Authorware Attain
Frame metaphor	Uses icons to specify interactions and links them conceptually providing a structural flow	StorySpace, Digital Chisel, Astound, Quest, Multimedia Fusion
Hierarchical object metaphor	Uses an object metaphor like Object Oriented Programming which is visually represented by embedded objects and iconic properties	Dazzler Deluxe, Docent, Metropolis, MediaSweets, Toolbook II Instructor, Quest Net +, Oracle's Media Objects
Hypermedia linkage	Uses a hypermedia navigation metaphor to link elements	FrontPage, Dreamweaver, Homesite, Claris HomePage
Tagging	Uses tags in text files to link pages, provide interactivity and integrate multimedia elements	SGML, HTML, VRML, 3DML
Cast-score metaphor	Uses horizontal tracks and vertical columns to synchronize media events in a time-based fashion	Director, Flash, Javascript, Java

Authoring paradigms can be thought of as organizational structures that facilitate the design of instructional materials and learning activities. Depending on the paradigm used by a specific authoring tool, the design approach, development time, instructional capabilities, and learning curve (ease of use), could vary widely from one authoring tool to the next. Hedberg and Harper (1998) emphasize this point by stating that: "The organizing metaphor of the authoring system has become critical to the effective design of the final learning environment" (p. 1). Kasowitz (1998) however insists that the value of an authoring tool is measured by how well it can support a particular designer's task regardless of its strength or approach. In order to understand how authoring tools impact a designer's task, it is important to look at the evolution of authoring tools from a technological and pedagogical perspective.

Evolution of Authoring Tools

Authoring tools have evolved over the last decade based on technological and pedagogical innovations from authoring bounded, program-controlled learning systems such as Computer-Based Instruction (CBI), to authoring unbounded, learner-centered environments such as Web-Based Instruction (WBI). From a technological perspective, the Internet has revolutionized teacher-to-learner and learner-to-learner communication by making these interactions time and place independent through the use of email, discussion boards, and other Internet-based technologies that facilitate asynchronous learning and information delivery. Web-based course management tools now include such features and components under an integrated structure. The World Wide Web (WWW) has also dramatically altered the concept of hypermedia, which is a crucial attribute of an authoring tool's interface. Hypermedia has evolved from a predetermined finite internal linking structure contained within the boundaries of a learning system to an infinite external linking structure that knows no boundaries. The WWW has also changed the nature of instructional content and resources from a well-defined and stable knowledge base to an unfiltered and dynamic information base. CDROM-based authoring tools for example have commonly relied on stable content to organize and structure instruction, which is why the resulting learning system is bounded and program-centered. Alternatively, Web-based course management tools now include features and components that allow instructors and learners to modify content and contribute resources resulting in flexible and active information structures.

From a pedagogical perspective, this means more flexibility in the design of WBI. Depending on how the tools' features are used in a course by the instructor and the learners, the "pedagogical philosophy" underlying the teaching and learning process can range from a strict instructivist approach to a radical constructivist approach (Reeves & Reeves, 1997). A strict instructivist approach typically results in a Web-based course that has a tutorial structure in which the content is organized by the instructor and *delivered* or imparted to the students; and a radical constructivist approach typically results in a more learner-centered pedagogy where students use Web features as tools to construct their own knowledge representations by restructuring content and creating and contributing their own resources to the course structure (Bannan & Milheim, 1997; Reeves & Reeves, 1997). It is more likely therefore that courses initially designed for traditional learning environments and later transformed to a Web-based format using a Web-based course management tool will undergo a *pedagogical reengineering* that is more constructivist in nature (Dabbagh & Schmitt, 1998). The presence of Internet-based communication tools, collaborative tools, and Web publishing tools in Web-based course management authoring systems make such pedagogical implications possible.

Instructional Products of Authoring Tools

The nature of instructional products has also evolved with advances in authoring tools. Interactivity as an instructional variable can no longer be "trivialized to simple menu selection, clickable objects, or linear sequencing" as is the case with most program-controlled CBI (Sims, 1995). Ambron & Hooper (1988) describe interactivity as "a state in which users are able to browse, annotate, link and elaborate within a rich non-linear database" (cited in Sims, 1995, p. 1). Web-based course management tools include note-taking tools, Web development tools, self-assessment tools, communication tools and collaborative tools for learners, encouraging a continuous dialogue between the user and the courseware such that the learner is productively and continuously active (Jonassen, 1988). This dialogical view of interactivity seems to align with a learning strategies perspective where learners are using technological tools as cognitive tools to generate their own learning (Sims, 1995). For example, with the inclusion of learner tools in authoring systems, learning environments are becoming increasingly student-centered. Learners can create and organize information in a meaningful way and take responsibility for their own learning.

Another variable that has greatly influenced instructional products developed with authoring tools is the ease with which collaborative activities can be facilitated with Internet-based technologies embedded in Web-based course management tools. The focus shifts from interaction with an instructional program to human interaction in the context of group activities. With user-specific tools, connectivity, and greater ease of use, opportunities for goal-oriented projects by teaming students to work on creating Web based projects can be truly maximized.

CBI and WBI: Instructional Attributes

In order to better understand the evolution of authoring tools from a pedagogical perspective it is important to compare the instructional attributes of Computer-Based Instruction (CBI) and Web-Based Instruction (WBI) since these are the two primary instructional or 'courseware' products generated through the use of authoring tools, with the understanding that CBI utilizes CDROM (or non-Web-based) technology to deliver its courseware, and WBI utilizes Internet (or Web-based) technologies. The type of delivery medium has played an important role in determining what instructional designs are possible. As Clark and Lyons (1999) state: "The lesson that we have learned over decades of technological evolution is that each new medium provides instructional capabilities that are unique. And each medium demands a new approach to exploit its capabilities for promoting learning." Table 2 compares and contrasts pedagogical attributes of CBI and WBI on instructional approaches, content features, instructional activities, scope of interaction, feedback, and evaluation.

Table 2 – Instructional Attributes of CBI and WBI

CBI – Instructional attributes	WBI – Instructional attributes
Lends itself to a program-centered or instructivist approach due to the closed-system nature of the courseware, hence the need to predetermine the instructional content and instructional interventions (automated delivery)	Lends itself to a student-centered or constructivist approach due to the open-system nature of the courseware, hence the potential of dynamically altering the instructional content and instructional interventions
Content is fixed, has an inherent structure and remains generally stable no matter when it is accessed by a user	Content is dynamic, instructors and learners can contribute new knowledge and add new resources to the course content
Instructional sequence and learning contexts are externally driven by objectives and tasks	Instructional sequence and learning contexts can be internally driven by learners
Restricted to references and resources embedded in product (browsing is limited to the particular CDROM)	Links to a multitude of Web sites can be readily embedded (browsing is [un] limited to the WWW)
Focus is generally on creating sequential media such as print, audio and video	Focus is shifting from media delivery tools to communication tools
Instant feedback is available through programmed interactions but less potential for personal or meaningful feedback	Learner-to-learner and instructor-to-learner interaction options providing meaningful peer and instructor feedback
Limited interaction with other learners and instructor	Unlimited interaction with other learners and instructor
Instructional activities typicaly consist of drill and practice exercises, trial and error learning or simulations with accelerated rounds of skill practice	Instructional activities generally consist of browsing links, searching online databases, posting using threaded-discussions and email, Web publishing
Testing of learner outcomes generally involves pre-tests, posttests, and multiple-choice questions	Testing of learner outcomes generally involves assessing communication skills, Web-based projects, organization of information and synthesis of content
Lends itself to criterion-referenced assessment	Lends itself to authentic assessment (peer evaluations, multiple assessors, and multiple forms of assessment)

A noticable shift from directed to open-ended hypermedia learning environments can be detected in the instructional attributes listed above. According to Hannafin, Hill & Land (1997), directed learning environments use "structured algorithmic approaches to convey a discrete identifiable body of knowledge" and "learning is externally driven via explicit activities and practice." Directed learning environments can also be described as bounded (well-defined), happening in real time, instructor (or program) controlled, and relying on stable information resources (Chambers, 1997). The instructional attributes for CBI listed above certainly fit these criteria. Open-ended learning environments (OELE) on the other hand emphasize generative learning, authentic contexts, and guided discovery approaches where learners take responsibility of learning and evaluate their own needs (Hannafin et al., 1997). Additionally, in OELEs metacognitive abilities take precedence over mastering content and asynchronous communication is paramount in supporting learning tasks. WBI however can still result in a directed approach if the inherent features of the Web are not effectively utilized by all participants in the learning environment. For example, it is possible to design a Web-based course that is self-contained and requiring minimal instructor intervention and interaction with other learners. Practice and feedback activities can be embedded in a Web-based course much like they would be in a CBI course and learners can proceed through linearly-sequenced tutorial-like content presentations at their own pace, resulting in a program-centered learning environment. Caution must be exercised to insure that WBI is not just CBI delivered over the Web.

Classes of Authoring Tools

Authoring tools can be grouped using several variables e.g. type of author/adopter (e.g. corporate developer versus teacher educator), type of delivery medium (e.g. CDROM versus Internet), type of operating system (Windows versus Macintosh), type of scripting metaphor, cost, ease of use, range of user base (e.g. learners, instructors, developers), level of technical support, type of interface, market share, media capabilities, instructional design capabilities, etc. In this paper, authoring tools are grouped by the type of delivery medium (CDROM versus Web-based), and the type of instruction produced relative to the specific features of the delivery medium (CBI versus WBI). The reason for this grouping is based on two principles. First, that the effectiveness of an authoring tool can best be measured by examining the types of instructional and learning strategies it supports (Dabbagh, Bannan-Ritland, & Silc, 2001); and second, that to date, authoring tools have been primarily used to develop two types of instruction: Computer Based Instruction (CBI) and Web-Based Instruction (WBI).

Although most authoring tools designed to deliver instruction on a CDROM have Web delivery capabilities (Internet "play" capabilities through the use of plug-ins), those tools were not originally designed to take advantage of the inherent and unique features of the Web such as connectivity, asynchronous communication, global accessibility, and ubiquitous use. Based on this fundamental distinction we classify authoring tools into two main categories: CDROM-based and Web-based. Examples of CDROM-based authoring tools are Hypercard, Authorware, and Toolbook. Examples of Web-based authoring tools are Macromedia's Dreamweaver, Claris HomePage, and Microsoft's FrontPage. Figure 1 provides a visual of these two classes of authoring tools and some distinguishing characteristics of each.

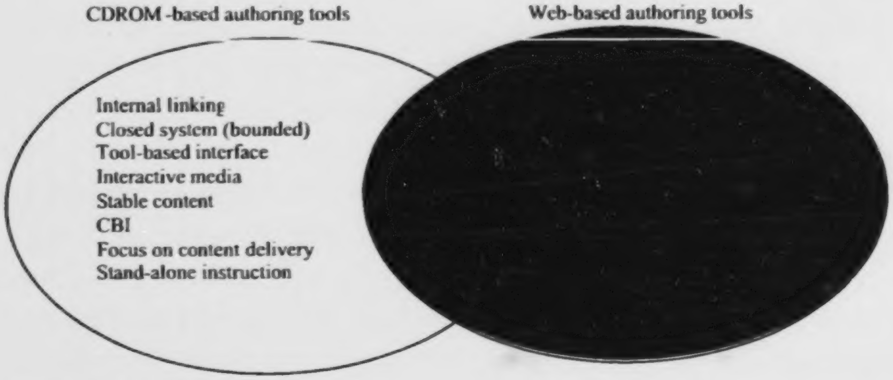

Figure 1 – Classes of Authoring Tools

Web-Based Course Management Tools

Another class of Web-based authoring tools known as Web-based course management tools emerged when Web-based authoring tools were being increasingly used to create Web-based courses for online learning. The need for a more integrative structure to manage the delivery of such courses and facilitate the migration from face-to-face classroom instruction to WBI, resulted in the development of "one stop one shop" applications such as WebCt and Blackboard. Unlike previous Web-based authoring tools, those tools include instructor tools, learner tools, and technical administration tools allowing for different types of users, and for multiple Internet-based activities embedded within the tool itself. Table 3 lists the three classes of authoring tools identified above and the general features of each.

Table 3 – Features of Authoring Tools

Category	General Features	Instructional Products
CDROM-based Authoring Tools Examples include: Hypercard, Authorware, Toolbook II, Director	• Tool-based interface • Utilized with CDROM and videodisc technologies • Closed system (does not allow user to go beyond the boundaries of what's there) • Content is generally stable • Most linking is internal, could have external links requiring firing up a browser • Can be Internet-enabled through "plug-ins" • Require installation therefore operating system dependent • Require a steep learning curve in order to take full advantage of their features • Used mostly by developers	• Computer-Based or Computer-Assisted Instruction (CBI/CAI) • Simulations • Games • Microworlds • Tutorials • Individualized instruction • Programmed Instruction • Self-contained interactive modules • Mastery learning • "Canned" or stand-alone instructional products • Standard testing programs (e.g. SAT) • Criterion-based testing

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	and instructional designers to produce instructional software • Do not have specific instructor or learner tools (only developer tools)	
Web-based Authoring Tools Examples include: FrontPage, DreamWeaver, Claris Homepage, Homesite	• Browser interface • Utilized with Internet-Based technologies • Open system (allows user to go beyond the boundaries through external linking to the WWW) • Extensible • Dynamic content • Enables active/collaborative media • Require a steep learning curve in order to take full advantage of their features • Used by a variety of users to develop Web sites for multiple purposes • Do not have specific instructor or learner tools	• Single Web pages and integrated Web sites for the purposes of information presentation to support classroom instruction • Structured Web sites resulting in a variety of formats for WBI • Personal and institutional homepages • Web publishing • Organization of Web-based resources • Complex animations and interactions when used with high level scripting languages (Java, Javascript, C++) and other Web development tools
Web-based Course Management Tools Examples include: WebCt, Blackboard, TopClass, Virtual-U, LearningSpace	• Browser interface • Utilized with Internet-Based technologies • Open system • Easy to use • Dynamic content • Enables active/collaborative media • Have specific tools for instructors, learners and administrators • Embedded communication tools (email, discussion forums, group tools) • Used primarily to manage and deliver online learning in educational institutions and online training in corporate settings	• Distance education programs • Courseware (WBI) • Knowledge networks • Asynchronous & synchronous learning environments • Distributed learning environments

Scalability and Usability

It is evident from the table above that authoring tools have evolved on three fronts: networkability, level of use (user-base), and ease of use. CDROM-based authoring tools were primarily designed for software developers and became popular mechanisms for supporting the production of CBI where learners interact with an instructional program to gain mastery of a certain skill or knowledge (Kasowitz, 1998). The World Wide Web (WWW) shifted the focus of interactivity from interaction with an instructional program to interaction with other learners (global interaction) (Kearsley & Shneiderman, 1998), and from accessing materials on bounded delivery vehicles such as CDROMs to accessing unbounded and dynamic information through a network of global resources on the Web itself (Clark & Lyons, 1999; Hedberg, Brown, & Arrighi, 1997).

The WWW also created the need for tools to develop Web pages which began with simple text editors to create HTML files and evolved to Web-based authoring tools which continued to grow in functionality integrating more user features and Internet-based technologies leading to the development of Web-based course management tools. The learning curve dropped sharply with Web-based course management tools as the interface became more template-controlled ("choose-it-and-we'll-do-it-for-you") and the functions more context sensitive, extending the user-base to multiple user profiles. With little or no prior experience in authoring, instructors, learners, university administrators, and corporate developers are all able to easily explore the potential of these integrated tools to create, engage-in, manage, and deliver online learning.

Current Authoring Tools

Authoring tools can be traced back to the 1960s when "computer-assisted instruction was viewed as an economically viable way to distribute teaching expertise" (Huntley & Alessi, 1987, p. 259). In 1997, Kozel documented about 50 commercial multimedia authoring tools not counting highly specialized niche tools. Most of the market's share was spread among the most popular tools: Aimtech's IconAuthor, Allegiant's Supercard, Allen Communication's Quest, Asymetrix Toolbook II line (Asymetrix is now Click2Learn), Macromedia's Director and Authorware, and mFactory's newer object-oriented metropolis. Currently, Macromedia claims to own 80% of the authoring market between their two tools, with Director possibly dominating this market share. Other tools with a loyal following include: Claris' Hypercard, Oracle's Media Objects, Apple's MediaTool, and Discovery Systems CourseBuilder.

In a survey on the usage of Web authoring tools on the Web conducted by Security Space in July of 2000, the following WYSIWIG (What You See Is What You Get) tools were listed in descending order of percentage use: Microsoft's FrontPage, Netscape's Composer, Adobe Page Mill, NetObjects Fusion, HotMetal Pro, IBM HomePage Builder, NetObjects Authoring, Macromedia's Dreamweaver, Allaire's Home Site, and IBM NetObjects TopPage However when taking the mind-set of a professional Web developer responsible for a medium-sized company's Web efforts, Oliver Rist of InternetWeek (1998) selected three WYSIWIG Web authoring tools that are powerful enough to develop cutting-edge pages, yet visual enough to do so quickly and easily. The three tools were Microsoft's FrontPage, Adobe's Page Mill, and Macromedia's Dreamweaver, with FrontPage coming out on top in terms of an "all-in-one professional-level design and management tool", and Page Mill and Dreamweaver following closely behind. In a more recent roundup of Web-based authoring tools, PC magazine in its May 4th, 2000 issue gave Dreamweaver first place for advanced site design with an average user rating of 9/10, and FrontPage first place for basic site design with an average user rating of 7/10. Allaire's Home Site received an honorable mention in the same issue and was highly recommended for developers who prefer complete control over their HTML code due to its thorough code-editing capabilities.

Web-based course management tools (WBCMT) represent yet another share of the market which clearly lies in the education sector since the main purpose of these tools is to facilitate the management and delivery of online courses to support e-Learning and distance education programs. In a recent survey by the U.S. Department of Education's National Center for Educational Statistics (NCES), it was reported that the number of distance education programs increased by 72 percent from 1994-95 to 1997-98 and that an additional 20 percent of the institutions surveyed plan to establish distance education programs within the next three years (The Institute for Higher Education Policy, 2000). It was also reported that 1.6 million students were enrolled in distance education courses in 1997-98. It is not surprising therefore that institutions and faculty members are increasingly feeling pressure to offer Web-based courses to meet economic and student demands and the recent proliferation of WBCMT seems to be in answer to this demand. Examples of WBCMTs include WebCt, Blackboard, Convene, Embanet, Real Education, eCollege.com, Symposium, TopClass, WebMentor, E-Web, Web Course In A Box, Internet Classroom Assistant, Lotus Learning Space, Softarc's FirstClass, Serf, Virtual-U, and Eduprise to mention a few.

Eduventures.com (a leading e-Learning independent industry analyst firm), in an October 2000 industry research report established that Blackboard had the strongest market position at the time the report was published. The same report also stated that WebCt had also reached a sizable share of the market and that with its partnership with Thompson Learning it is in an excellent position to match or even surpass Blackboard in the coming months. The report mentions Campus Pipeline and Jenzabar as other WBCMT category leaders in e-Learning (Stokes, Evans, & Gallagher, 2000). Eduventures.com also predicts that the higher education e-Learning business will eventually be dominated by two or three large players, or maybe even one "killer" player. Other popular Web-based course management systems include Learning Space, Virtual-U, and TopClass (Mann, 1999). For a more comprehensive list of authoring tools and a comparative analysis of their features, visit Bruce Landon's Website at: http://www.ctt.bc.ca/landonline/index.html.

Future Implications of Authoring Tools

As discussed at the beginning of this paper, the aim of authoring tools is to automate entirely or partially the courseware construction process by supporting tasks such as the ability to create screens, screen objects such as menus and buttons, link content to other content, and sequence material (Bell, 1998). The lack of specific design principles however often restricts the kinds of instructional designs these tools support leading in many instances to the creation of simple drill and practice programs or uninteresting tutorials. "The result is a tool that supports a broad range of possible instructional applications, some of which may be good, and some of which are likely to be poorly executed, but none of which will have been created with much guidance from the tool itself" (Bell, 1998, p. 76). Murray (1998) further emphasizes this shortcoming of authoring tools when he states that "commercial authoring systems excel in giving the instructional designer tools to produce visually appealing and interactive screens, but behind the presentation screens is a shallow representation of content and pedagogy" (p. 6). So how do we preserve the level of usability and the instructional methods that instructional designers have become familiar with, and add additional tools, features, and authoring paradigms that will allow more powerful and flexible learning systems to be built?

There are two approaches that attempt to answer this question both based in an information technology perspective. The first proposes that Intelligent Tutoring Systems (ITS) need to be embodied by authoring tools to allow additional levels of abstraction, modularity, and visualization in order to achieve more powerful and flexible authoring paradigms (Bell, 1998; Murray, 1998). The second proposes that new metaphors for authoring tools need to be developed to match current theory (Hedberg & Harper, 1998), and that "of all the metaphors likely to survive, *objects* stand the greatest chance because they reflect an evolutionary improvement in the software engineering world" (Kozel, 1997, p. 42).

A New Authoring Paradigm

The object model represents an inevitable evolution in application development since interactive multimedia is both created in and delivered as software making it easier to author complex programs by thinking of interactive elements as objects. The organizing metaphor of the authoring system has become critical to the effective design of the final learning environment (Hedberg & Harper, 1998). This calls for a new authoring paradigm allowing users to spend more time designing at the conceptual and pedagogical level instead of focusing on the features of the tools to produce more engaging instructional designs (Robson, 2000). Currently for example, authoring tools for the construction of Web documents offer a page metaphor with hypertext as the dominant link structure allowing more of a "top-down" design process than the screen metaphor of more traditional low level multimedia authoring tools such as HyperStudio (Hedberg, Brown, & Arrighi, 1997). All to say that the paradigm or metaphor of an authoring tool can guide or restrict the types of instructional designs possible.

Object Oriented Designs

Both the ITS approach and the dominance of a 'true' object metaphor have one objective in common: introducing a pedagogical layer to an authoring tool in order to enable the design of more intelligent and flexible learning environments. According to Murray (1998) this is primarily achieved by representing instructional strategy and instructional content separately and by modularizing the instructional content for multiple use and reuse. This principle allows for embedding the pedagogy in the tutor for the proponents of the ITS approach, and in the properties of objects for the proponents of the object-oriented model. Such tools (in which strategy and content are separated) can facilitate the design of instructional actions by modifying the behavior of an intelligent tutor (in the ITS case), or specifying the relationship between objects (in the object model) based on the specific needs of the learner or the pedagogical characteristics of the content being taught.

Currently most authoring tools limit the designer to the pre-programmed modules of the tool and to the underlying assumptions of highly structured instructional design models (Hedberg & Harper, 1998). Furthermore, the typical ID process makes it difficult for instructors to communicate their content requiring instructional designers to see a lot of content in order to understand what the instructor wants (Robson, 2000). An object oriented approach would resolve this problem since it would be easier for instructors to translate their content into learning resources (e.g. I use lectures, assessment items, resources, etc.) and instructional designers can then create a prototypical environment matching the instructor's expectations without seeing any content at all (Robson, 2000).

Learners as Producers of Hypermedia Learning Systems

Another critical factor that could impact the pedagogical use of authoring tools is whether the learner is perceived as the *user* or *producer* of hypermedia learning environments. Hedberg et al. (1997) argue that if the activities of the learner are regarded as the central focus in an educational context then learners should be thought of as software (courseware) producers rather than software users in the development of educational software for both bounded CD-ROM titles and unbounded Web-based resources. They propose the integration of learner tools that allow users for example to organize information in a meaningful way by positioning elements on the screen, creating new links, and generating multimedia objects. Such cognitive tools could include a notebook to copy, edit and format text; a visual graphics tool to create marker buttons that point to multimedia elements such as video, audio, or pictures and enable the learner to manipulate those elements; and a cognitive mapping tool (concept mapping tool) allowing flexible information representation. The *learners as producers* concept supports a generative approach to learning, which aligns with a constructivist epistemology.

Learning Objects Systems Architecture

Learning objects systems architecture is also paving the way to support the generative use of authoring tools (Bannan-Ritland, Dabbagh, & Murphy, 2000). A learning objects system adopts an object-oriented approach for storing and metatagging instructional content and instructional strategies. Uneditable media objects called 'primedia' can be stored in a database and accessed for multiple uses in multiple contexts. Primedia can range from low to high granularity depending on their relative size as a learning resource, with highly granular resources increasing the efficiency of online instructional support systems due to their greater potential for reusability (Quinn, 2000; Wiley et al., 1999). With database-driven websites becoming increasingly popular it is certain that the future of hypermedia learning environments will be powered by such technologies instead of the static, 'hard-coded' HTML documents. Authoring systems will be designed for the creation of generically encoded reusable information allowing the design process to proceed by specifying learning resources, creating links among the resources and authoring content independently of format (Davidson, 1993; Robson, 2000). The idea is to define learning objects or resources such that each learning resource has specific instructional properties enabling its pedagogic integration with other resources. Depending on who creates, assembles and links these objects, the pedagogical philosophy of the hypermedia learning environment can vary from an instructivist to a constructivist approach resulting in a directed or open-ended learning environment as discussed earlier in this paper when comparing and contrasting CBI and WBI.

Currently Web-based authoring tools and Web-based course management tools do not facilitate the construction of learning objects however they do support some reusability of content due to the inherent archival nature of the Web as a delivery medium. They also support cognitive tools that enable users to engage in reflective and collaborative practices. In an evaluation of Web-based course authoring tools conducted by Dabbagh, Bannan-Ritland, and Silc (2001), it was revealed that the intersection between pedagogical considerations and the attributes of Web-based authoring tools yields the most educational impact. It was suggested that a comprehensive advisement mechanism included within Web-based authoring tools, and providing guidance in the areas of pedagogical approach, instructional strategy, and on-line support and resources will facilitate more effective and engaging instructional designs. Perhaps such a pedagogical advisement layer can be embodied by authoring tools using an ITS approach or a learning objects systems architecture approach in the future in order to enable the design of more intelligent and flexible learning systems.

Conclusion

This paper discussed the heuristic paradigms and organizing metaphors underlying authoring tools and their impact on the design of hypermedia learning systems. In addition, the evolution of authoring tools from a technological and pedagogical perspective was discussed by comparing and contrasting the instructional attributes of the two primary courseware products developed using authoring tools: CBI and WBI. Three classes of authoring tools were also identified and the features and associated instructional products of each class were provided. Finally, an overview of current authoring tools, their market share, perceived shortcomings, and new authoring paradigms and their implications on the design of intelligent and flexible learning systems was discussed.

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Women and Men in Online Discussion: Are There DifferencesIn Their Communication?

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Abstract

This paper describes two studies involving men and women ($n = 13$) who participated in online discussions in a web-based graduate course. The purpose of both studies was to examine the frequency and types of responses these students made during the course chats and threaded discussions. The first study was occurred at the end of the course in a two-week period. Students were divided into 2 small groups in which one group discussed the assigned topic via chat while the other group discussed the same topic via threaded discussion. The following week, these groups switched discussion formats to discuss a second topic. Results of the first study indicate that both chats and threaded discussion (the primary focus of the original study) were valued and had utility. However, an unanticipated result indicated a variation in the number and type of statements made with one of the small groups versus the other. It was found that the majority female group made more frequent statements than the majority male group. This finding was contrary to our review of research in regard to 2 points: 1) results and discussion that indicate that online discussion is an equalizer between men and 2) results that indicate that females were less involved. Hence, we examined other discussion of students using both online formats involving at various points within the same course and semester. Results of the second study indicate that there were some differences in the types of statements, but he amount of statements made by both genders on average was equivalent within mixed-gender, large group discussions in the sampled 4 weeks. The findings of this second study confirmed CMC studies that indicate gender equity. However, the initial study's esults are still viable. Perhaps when in same gender groups, the genders use typical communication styles in discussion and when in mixed gender groups, the discussions are equivalent in number of statements for both genders. Additional research is necessary into this issue of gender and online discussion.

Background of the Studies

Web-based and web-blended (enhanced) courses require active and interactive participation with all participants (instructor and students) and with instructional materials posted or linked to a web site. Active participation is usually conducted by locating or providing information and posting this information to a designated web site, such as shared documents, external links, and online biography of student and staff information. Interactivity requires the interchange of ideas with all participants. This interchange of ideas occurs mainly through online chats or threaded discussions. (Davidson-Shivers, Muilenburg, & Tanner, (in press), 2000; Davidson-Shivers, Morrison, & Sriwongkol, 2001; Davidson-Shivers & Rasmussen, 1998, 1999).

The computer-mediated communication (CMC) literature documents the dynamics of online discussions by various forms of communication patterns, processes, and language styles (Lawley, 1993; Adkins & Brasher, 1995; Sherry, 1999; Hara, Bonk, & Angel, 1999.) Lawley's article discusses communication and computers in terms of gender as a social construct and the political effects of technology, such as the dehumanizing aspects of technology and viewing the user as shaping the process and environment, especially virtual environments. Adkins and Brasher's study of CM groups suggests that language style of powerful and powerless speech affect interpersonal perception—being that the powerful was perceived as being more task-attractive and competent. Another finding indicated those members perceived of higher status were given more opportunity to talk. Machanic (1998) discussed the need to have institutions and instructors establish procedures and safeguards to prevent harassment and nastiness occurring in online discussions and facilitate a sense of safe community.

Other studies focused on gender differences in communication patterns in online discussions (Vrooman, 2001; Proost, Elen, & Lowyck, 1997; Wojahn; 1994; McConnell, 1997; Ross, 1996; Herring, 1993; Allen, 1995). Herring also claims that the belief that CMC is inherently more democratic than face-to-face communications may be overly optimistic with respect to gender. In her ethnographic study of academic professionals, she found that women did contribute less and with shorter statements than did the males. Ross also found that females participated less than males in small group discussions and discussed their families whereas men did not contribute to messages referring to family. While Mahoney and Knupfer (1997) suggest that research on women and language reveal that women can experience linguistic discrimination within CMC and that cyberspace is not a gender-neutral space, a recent article by Vrooman argues that online environments can produce a more equitable area for communication from both genders.

In addition, Allen's case study of men and women using the electronic mail system found no difference in number of messages sent an length of time using email; however, females rated the email more highly in various categories and reported learning from co-workers than men. In addition, Allen suggested that females tend to be socialized by supportive and nurturing. Proost, Elen, and Lowyck in their survey found that it was experience rather than gender being responsible for different perceptions of CMC environments. Wojhan compared the adult communication patterns by gender using a bulletin-board communication format; she found that the length of communication patterns of men and women was very similar. McConnell, when comparing patterns of men and women in mixed gender groups, found that men tended to talk more and longest in computer conferencing, but that women may be less disadvantaged in conversations in online than in face-to-face. Hence, there was some discrepancy in terms of contributions within CMC environments.

Based on conflicting information within the literature, the results of two studies are being examined in terms of gender equity and possible influencing factors. The purpose of the paper is to describe the methods employed in the two studies, discuss the results of each study, and identify potential influencing factors that may affect (or determine) gender equity in online discussions and that call for further research.

Methodology

Participants

Participants in the study were graduate students (n = 13) in a required course for their degree programs of study from a southeastern regional university in the USA. Approximately two-thirds of the students were female. Based on the survey results, the majority of students reported that they had computer experience with some having less experience with the Internet and WWW. Participation in the discussions was a course requirement. Confidentiality of information was maintained by having surveys collected and coded by someone other than the instructor and the analysis of the discussions occurred after final grades were posted.

Course content, organization, and requirements

The course was an introductory course on trends and issues in instructional design. The course was organized by weekly topics with assignments and questions being posted to its website. Two or three questions were given with directions on how to post (either chat or threaded discussion) answers and replies. Students had a week to respond to any listserv question(s) and were also required to reply at least twice to other students' responses during the week. Typically one additional question was scheduled for an hour and a half chat during the week. Chats were large group (whole class) in which most students were able to attend. Students were also assigned particular readings as preparation for discussing the weekly topic. They were also encouraged to draw on their own experiences, knowledge and skills. Both threaded discussion and chat could be copied and all of the chats were distributed to all members of the class. After the fifth week of the term, students were assigned as discussion leaders to facilitate the weekly discussions in both chats and threaded discussions with guidance from the instructor. The instructor participated directly in the online chats; however, less so when another student was the discussion leader. With the threaded discussions, she added her comments to a summary at the end of the week rather than commenting during the week.

Data Gathering Procedures

The following procedures occurred for gathering the data:

1. Obtaining Transcripts of chats and threaded discussions.

Study 1: Transcripts of the small group discussions for chat and threaded discussion for week 13 and 14 were coded using a coding scheme developed by the Davidson-Shivers et al (1999) based on the work of Piburn and Middleton (1998) and Williams and Meredith (1996). See Table 1 for the coding scheme.

Study 2: Transcripts of the discussions for 4 different weeks (weeks 5, 7, 10 & 15) were then coded using same coding scheme. There were two threaded discussion questions and one chat for each week; all of these discussions were whole class rather than students being divided into small groups.

2. Training of researchers.

The researchers were trained to use the coding scheme and then coded each discussion transcript independently. The transcripts were coded by each completed statement/thought made rather than using a line-by-line method. The coding and analyses of the discussions did not occur until after the final course grades were posted. Complete sentences, incomplete sentences, and short phrases were considered as a statement if a new or different thought was presented within them. Incomplete sentences or short phrases were often used within the chat due to the speed and interactive nature of this format.

3. Handling discrepancies in coding.

Discrepancies encountered in the coding were resolved by review and discussion of the statement and the researchers coming to consensus.

4. Surveys were analyzed for demographic data, computer and web experience, and attitudes toward web-based instruction.

Table 1. Types of Discussion Participation Coding Scheme

SUBSTANTIVE:* *messages that relate to the discussion content or topic.

Code 1. **Structuring** – Statements which initiate a discussion and focus attention on the topic of the discussion. These statements are often made by the discussion leader or instructor (i.e. "Today we are going to discuss . . ." or "This week's discussion will focus on . . .").

2. **Soliciting**—Any content-related question, command or request which attempts to solicit a response or draw attention to something (i.e. "What do you think the author meant by . . .?" or "Give us some support for that assertion.").

3. **Responding**—A statement in direct response to a solicitation (i.e. answers to questions, commands, or requests). Generally these are the first response to a question by a given individual.

4. **Reacting**—A reaction to either a structuring statement, to another person's comments, but not a direct response to the question. (i.e. "Your earlier statement got me to thinking about . . ." or "I agree/disagree with Bob because . . .").

NON-SUBSTANTIVE:* *messages that do not relate to the discussion topic or content.

5. **Procedural**—Scheduling information, announcements, logistics, listserv membership procedures, etc.
6. **Technical**—Computer-related questions, content, suggestions of how to do something, not related to the topic directly.
7. **Chatting**—Personal statements, jokes, introductions, greetings, etc.
8. **Uncodable**—Statements that consist of too little information or unreadable to be coded meaningfully.
9. **Supportive**—Statements that although similar to chatting, there is an underlying positive reinforcement to the comment! (i.e. "Good idea!" or "Excellent work!"). *Note:* This type was added when the researchers met for consensus of their coding of the transcripts.

Source: Davidson-Shivers, Muilenburg, & Tanner, 1999. Adapted from Piburn & Middleton (1998) and Williams & Meredith (1996).

Results

Study 1

In the initial study, students were randomly assigned to either a small group chat or threaded discussion during one week of the course (week 13). In the second week (week 14), the same groups switched discussion modes on another topic question. Using qualitative methods and a coding scheme, the researchers coded the transcribed discussions to find out whether of the students' participation were substantive (directly related to the topic) or non-substantive (not directly related to the content) in nature. Results indicated that overall students' discussions included all 9 types of substantive and non-substantive comments. However, it appeared that there was a remarkable difference in terms of types and amounts of responses between these two groups.

The majority female group had greater numbers of responses and reactions (substantive categories) in both chat and threaded discussion than did the majority male group. In addition, the majority female group made more chatting and supportive comments (nonsubstantive categories) than did the males during the two-week period. When reviewing these patterns in terms of face-to-face situations, the findings are not that surprising. Tannen (1990) suggests that females in face-to-face conversations with each other, tend to use more words and elaborations as well as supportive comments than do males in similar situations. However, the results are in sharp contrast to findings in computer-mediated communication literature, which suggests that communication patterns of men and women in online discussions are similar (Wojhan, 1997; McConnell, 1997).

Study 2

In this second study, the focus was to analyze the interactions of these same students in chats and threaded discussions drawn from 4 different weeks (week 5, 7, 10 & 15). These discussions involved a mixed gender group. Results were mixed in terms of any differences in which gender had greater amounts of these two main categories over the four weeks. In terms, of the non-substantive categories, the females tended to have made slightly greater numbers of chatting and supportive comments than males. When comparing male and female discussion leaders the female showed a greater amount in those same two non-substantive categories than did the male leader. Both males and females showed the greatest amounts of messages in the responding and reacting (2 of the substantive categories) and were fairly equal in amount overall. It appears then that differences in male and female discussions are diminished when looking at substantive remarks in online discussions using a mixed gender group. The results of this second study supports the idea that CMC tends to be an equalizer among men and women when in mixed gender groups. However, the findings of the second study do not necessarily negate the results of the initial study. Perhaps when in same gender groups, men and women tend to revert to their natural patterns of conversation.

Discussion of Results

As suggested in the review of literature, perhaps there is opportunity for women to create a new model for online discussions and that females are less disadvantaged in online discussions than in face-to-face meetings after all (Wojahn; McConnell, Vrooman). And based on the initial study's findings, perhaps women can make a strong contribution in online discussion. However, there remains the question of why the findings in both studies may have occurred.

Pure speculation may indicate that when groups are same gender rather than mixed gender, communication may revert back to typical gender-based communication (Tannen, 1990). Tannen suggests that men use a parallel form of communication with each other which is when each communicate his own ideas without necessarily commenting on the other's; it tends to be a side-by-side type of pattern without much discussion or interrelationship between the males' comments.. Women tend to have a relational type of communication, in that one female states something that in turn is commented on by the other female and in a sense they take turns sharing and supporting ideas between themselves. Women often use more words and talk more than men; estimated at 25,000 per day compared to a man's 15,000 per day (source unknown).

The increase in amount of supportive statements by the female students may be indicative of a tendency for this gender to provide supportive comments to each other (Tannen, 1990) or acknowledge points made by each other (Wojahn, 1994). McConnell (1997) also suggests that men tend to support conversations at the end whereas women tend support conversations throughout the dialogue. These findings of the initial study, and to some degree the second finding, are similar to face-to-face conversations within same gender groups (Tannen, 1990; Wojahn, 1994; McConnell, 1997) as well as in terms of supportive comments being a female characteristic, whether biological or socially constructed (Herring; Lawley; Mahoney & Knupfer).

Students having had face-to-face communication prior to going online may also have evoked a feeling of community and allowed for initial impressions and perceptions of individuals to be made (Adkins & Brasher; Herring; Lawley). With such impressions, the second study may indicate that the powerful may not have been the typical perception of gender-based power, but that of one who displays confidence and higher status in the group discussions. In addition, the face-to-face may have facilitated safe feelings when going online (Machniac, 1998). Ross states that when students with high CMC skills may have been sympathetic to those less skilled students who encountered higher rates of technical problems. This phenomenon appeared to occur in the course as well, again promoting a sense of community and support.

The instructor's teaching style and manner helped established both in the oncampus class and online may have had an effect on sense of community. Procedures and safeguards may have been in place so that students felt safe as Machniac suggests. There is a tendency for males to do more flaming than females(Vrooman; Ross); yet, little to none of that occurred within the course.

Further Research Needed

This set of study yielded more questions than it answered and indicates that further exploration of communication patterns and gender in online dialogue is needed. First, the methodology of the various studies shared in this paper vary greatly, simple replication of the various studies will enhance the discussion on the issue of gender equity and online discussion. The type of group—mixed- or same- gender—may make a difference in the types and amounts of communications between and within gender. Investigations of the discussion patterns with use of whole class and small groups need to occur as well.

In addition, the effect of instructor presence, gender, and teaching style may make a difference on the gender equity in discussions with participating students. Such factors may relate to power of speech, perceptions of speaker, and language style as discussed by Herring and other scholars in the CMC literature. All of these factors may affect the interactions of students in online discussions and ultimately, the success of web-based instruction. It is an issue worthy of further examination.

Finally, examination of communication patterns of children and adolescents by gender as well as course content also needs to be considered. The topic of the course as well as age of the participants could add a richness of information to the discussion in terms of gender and online discussions.

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Defining the Limits: CyberEthics

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Abstract

How should people behave when using the computer? How did you learn "right" and "wrong" in cyberspace? We surveyed teachers and students to understand how each group views ethical online behavior. Our research indicates that while students and teachers share some insights, they do not share the same viewpoints on all cyberethics issues. This discussion will address the need for a common forum and interactive ways for sharing ideas on cyberethics issues to develop a student's ethical decision-making abilities.

Introduction

Ethical behavior online, particularly among young people, is of increasing concern to various segments of our society. Before we can influence this or any behavior, we need to understand the factors that shape it, including social influences, cognitive and emotional factors and attitudes. The purpose of this study was to study students' knowledge and opinions about online behavior and to ascertain whether their views differed from those of the adults around them. In order to provide an appropriate context for these questions, three areas need to be explored. First, what are the unique characteristics of ethics in cyberspace – what are the dilemmas, and how do we define ethics in cyberspace? Second, what do we know about moral development in general, and how does it transfer into cyberspace? Finally, what is the social context of online behavior, and how does it impact ethical behavior?

Issue I: Ethics and Cyberspace

Ethical Dilemmas in Cyberspace: Students often test the social limits of what is considered acceptable behavior, both online and in the real world. While it is the major transgressions that create headlines, routine decisions that have ethical implications are made every day by students of all ages. Often these decisions are made without careful consideration of these implications for individual students or for our society.

Three key types of issues have emerged: intellectual property, privacy/security and free speech/hate speech. Intellectual property issues include plagiarism, Internet file sharing programs like Napster, and software pirating. Privacy and security issues range from hacking to surveillance software such as the FBI's Carnivore and unauthorized cookies deposited from websites. Freedom of speech issues can be seen in the discussion of online censorship, cyberporn and cyberhate. All three types of issues host multiple opportunities for ethical decision making. Indeed these same issues are the subject of several contemporary works by lawyers, philosophers and computer scientists. (Hamelink, 2001; Lessig, 1999; Ludlow, 1996; Sykes, 1999)

Definitions of "Ethical" in Cyberspace: Regardless of the particular issue under discussion, both students and teachers question when it is appropriate to transfer our understanding of ethical behavior from the classroom to the online environment. However, students and educators do not necessarily share the same viewpoints on cyberethics issues, nor do they bring the same skill sets to the ethical decision making process. Most notably, while students often are more experienced in using online technology, teachers are more familiar with the process of ethical decision-making. Finally, there are many situations that do not have clearly defined social boundaries. When is it okay to download and use a picture? Is a web site with negative comments about fellow students an example of free speech or slander? Is bypassing the security of a system for a good cause heroic or unethical?

Issue II: Moral Development and Moral Education

Although little research on moral behavior in cyberspace has been conducted, we do have an idea of how students develop moral behavior generally. James Rest (1983) identified four major processes that contribute to moral behavior: moral sensitivity, moral judgment, moral motivation and moral character. Moral sensitivity relates to an individual's ability to recognize the moral dimensions of a situation. Moral judgement, which has been studied extensively by Kohlberg and Turiel, involves the ability to decide which course of action is more morally sound. Moral motivation recognizes the level of importance the individual places on acting morally, and moral character assesses the individual's ability to persist in a moral course of action even in the face of difficulties. According to Rest, all four processes interact to determine the observed final behavior. Research so far suggests that moral sensitivity (Bebeau, 1994) and moral judgement (Schlaefli, Rest & Thoma, 1985) can be enhanced by educational programs. Moral motivation and moral character have not been as clearly addressed. One component of moral motivation are the social norms of one's reference group.

Nancy Willard's research on cyberethics makes use of a similar model to Rest's. She has proposed examining the relationship of empathy to moral motivation, and applied Bandura's social learning theory to processes of disengagement, which may weaken moral character. (Willard, 1997; Willard, 2000). Results of her study are forthcoming and hold promise for understanding how teens make ethical decisions. (Willard, 2000).

Issue III: The Social Context of Behavior in Cyberspace

Efforts to study the social context of unethical cyber behavior are limited. Recent sociological work on the hacking community proves interesting. While headlines often portray the hacking community as a collection of "pathological" individuals, two studies address the complex social dimensions that define and negotiate the boundaries of acceptable behavior within this community (Himanen, 2001; Jordan and Taylor, 1998). The group ethos of this particular community dictates that hacking should not be used for theft or individual gain. In fact, these studies note that the hacking community has developed it's own set of standards to define "ethical" hacking. Jordan and Taylor note that this community ethos can distinguish between hackers and cybercriminals -- those who seek personal gain from their illicit actions. Himanen contends that hacking represents a change in approach to work. Hacking reflects "a general passionate relationship to work that is developing in the information age" and "…the hacker ethic is a new work ethic that challenges the attitude toward work that has held us in its thrall for so long." (Himanen, 2001:ix)

Purpose of the Study

The current study attempted to elicit information relevant to the issues described above. Specifically, the study was designed to assess students' and educators' intuitive understanding of ethics and ethical decision-making, their ability to apply that knowledge to cyber dilemmas, their understanding of how to teach and learn an ethical awareness, and their sensitivity to the social context of cyberethics issues.

Method

Focus Group Formation

Five focus groups were conducted using modified Socratic questioning (see below for a description of the procedure). Group 1 consisted of 5 post-secondary educators from Marymount University. Group 2 consisted of 5 K-12 educators from suburban Northern Virginia public schools. Groups 3-5 were drawn from counselors and campers at a summer computer camp in Washington D.C. Group 3 consisted of 15 late elementary and middle school students and Group 4 consisted of 16 high school students. The students in these groups came from a variety of neighborhoods around Washington D.C., however most were of higher socioeconomic status. Participants, who were mostly male, were attending the camp due to their interest in computer technology. Their computer expertise varied. Although this group is not representative of the population as a whole, their computer expertise and interest in cyberissues was desirable. This study was designed to define issues and gather information from those students most likely to be aware of situations which require cyberethical decision-making.. Group 5 consisted of 13 computer camp counselors. These participants were college students, most of whom had significant interest and expertise in computer technology. As with the younger groups, this groups expertise and interest level was significantly greater than the general population, but this was desirable in order to gather information from students on the "front lines". In addition, this group's experiences counseling younger children on their use of computers meant that they in some ways bridged the gap between educators and students. The focus groups were videotaped with the exception of Group 5, which was audio taped. The authors were present as observers for each group session.

Focus Group Procedures

For each group, objects related to computers and cyberethics issues were displayed on a table. These objects included items with an obvious connection to the issues discussed (e.g. a computer hard drive and an Acceptable Use Policy) as well as items that were more tangentially related e.g. plastic "bugs" and "worms". The group facilitator for all of the groups was an expert in Paideia methods of seminar discussion. The opening question invited the group to examine the items on the table and discuss their ideas with regard to these items. Follow-up questions were designed to encourage participants to elaborate on their own and each other's ideas. A final question was designed to relate the topics discussed to the participants' own experiences.

The focus group discussions were transcribed and analyzed thematically in order to determine issues of central importance to each group as well as to determine the similarities and differences in the issues raised by each group.

Results and Conclusions

Four major themes were identified across all of the focus groups studied. Each theme is identified and discussed below and illustrated with quotations from the focus group discussions.

Theme 1: The cyberethics "authority" recognized by students is much younger than the offline ethical authority.

When asked, "How do people learn ethics?" all groups recognized the importance of parents in shaping a child's basic understanding. Students explain: "I think people learn a lot of their ethics from their parents. Whether they get what their parents are teaching them or something else. But I think it's a lot from their parents or whoever raised them, and their parents give them a way to react to what others say so they can take it in think about it and what your primary values are probably shared with your parents." (High School) Teachers agreed: "Kids look to teachers, parents …to set examples by how they behave… Over a period of time you develop a hierarchy of values. You can compare a given situation and place in context. (You) learn from parents, others important in life that you value their judgement. (You) have to value it before it makes a difference to you." (Educators)

However, as children get older, the relative importance of parents declines: "It changes at different times in their lifetime. Young kids are more likely to accept parents and not question. They question more as they are influenced by others and then they question anything parents say in adolescence." (Educators)

Teens acknowledge that teachers aren't always the ultimate authority: "If you think about it…, your teachers haven't gone through these troubles (referring to cyber dilemmas) for years and your just going through them right now and maybe things have changed from when they were kids so on some points I think your friends are wiser about what you're going through than your teachers are." "Friends might put you on the wrong track, (but) teachers might too. Society has changed a lot, on some points." (High School)

When asked "How did you learn right and wrong in cyberspace?" students responded: "I taught myself right and wrong, especially because on the computer I taught myself how to fax things and how to fix programs." (Elem/Middle)

In fact when it comes to the Internet, the ethical course of action is often defined by those between 19 and 25 years of age: "… the Internet culture is controlled, not by 50 year olds or 60-year olds, it's us. Our age. We talked about when you sort of lose your ethics when you go to college… You're like, alright! Ethernet connection and you start downloading more MP3s than you would ever do, songs you hate, cause it was a fast connection. …my parents don't really understand the Internet at all so they can't really make ethical judgements based on it. So the ethics come from 19-year old high school students, the ethics that we use on the Internet. We say everybody does it, well everybody on the Internet or most people are Internet are probably under 30. The majority of that (group) is probably under (the age of) 25." (College)

To summarize, students and teachers recognize the important role parents play in shaping children's basic understanding of ethics. Both groups agreed that as students get older, the importance of parents and adults declines. Teens acknowledge that teachers aren't always familiar with contemporary dilemmas resulting from new technologies. In fact, when it comes to the Internet, ethics are often defined by young adults ages 19 to 25.

Theme 2: Students of different ages use different mental frameworks to decide ethical online behavior.

Online communities, like AOL or GeoCities, provide definition to the social boundaries that middle school students acknowledge. "When I first signed on to AOL, there's like email that says 'Welcome'... Then you check it and we printed and put it right in the center where everyone would see it so they would obey what AOL says. Like, don't hack, don't mess around with stuff. (The) long email says what you shouldn't do." (Elementary/Middle) "At GeoCities it didn't give me as long a set of rules, but the only reason you can get on there is to get a web site. So it has rules about what you make (for) your web site. When I started reading them, there are all the rules, pretty much the same: don't download things that are illegal things, don't download MP3s on your site." (Elementary/Middle)

High school students consider what is appropriate in terms of the "moral" or ethical impact their actions have on others and society at large. "I think it's appropriate to use (it) for school, but it's not right to send off a virus. You are destroying another person's property" "I had a romantic image of hackers like the movie Hackers for one, they bring down an evil corporation like the Westerns where the outlaw would kill the corrupt sheriff or something but a lot of times it's not like that at all because major corporations can lose billions of dollars and that can cause many repercussions like downsizing" (High School)

College age students often use a "legal" framework as their guide to "ethical" behavior. After extensive discussion about how to decide what's right in relation to the Internet, one college student reflected on the relationship between laws and ethics: "We keep talking about what is legal and illegal as our moral code. …A lot of people go by The Ten Commandments and some of those things are law, official United States law… But they are a kind of a code of ethics that we can go by and live by…." (College)

These students see the line of distinction between ethics and laws as a personal decision "You have to do it personally. You have to come to personal decisions…" "…the reason that we come to law is that ethics are personal, whereas laws are something that we share, that are attempting to sort of approximate the general ethics without imposing on ethical differences." (College)

Importantly, all age groups learn right and wrong in cyberspace from their hands-on experience. "People have to learn things from experience and I think that the only way of learning something no matter how much you believe them, you really need to learn for yourself." (High School) In fact, students suggest that ethics in general is learned through experience. "I don't believe that any form of ethics is learned directly... Ethics is learned indirectly from various sources." (High School)

To summarize, students of different ages use different mental frameworks to decide ethical online behavior. Middle school students use online communities, like AOL or GeoCities to define social boundaries. High school students consider what is appropriate in terms of the "moral" or ethical impact their actions have on others and society at large. College age students often use a "legal" framework as their guide to "ethical" behavior. For all age groups, right and wrong in cyberspace is learned from hands-on experience.

Theme 3: When considering "appropriate" and "inappropriate" behavior online, some issues are clear for both teachers and students, however many others are not.

Advances in technology create new challenges for ethical decision-making. While educators insist most cases are still a matter of "basic values," students at the college level suggest that cyberrules are different. Discussing intellectual property, educators explain: " You need to show (students)... they can achieve what they want in an honest way, these MP3s things are a good example, a lot of people understand why that might be wrong because they respect the artist. They don't (necessarily) see intellectual ideas as property the way music is the artists' property." For this educator, it's merely a matter of drawing parallels between intellectual property that students recognize and the new situations that emerge in cyberspace.

Younger students often express confusion over what's "legal," particularly when it comes to downloading music: "It depends, ...if you download live album tracks, that's illegal. But you can go to places like Listen.com and it's legal you can download it to a CD. Places have a license to have you copy it, that's what they are for." (Elementary/Middle) When referring to using graphics and music from an online web site, another high school student explains: " If the person tells you ok, the person with the Web page and MP3s, (says)... click here if you want it, (they are) giving (you) permission. As long as you have your friend's permission." (High School) "Like I was saying about plagiarism laws, it's really not illegal until you start trying to make money off somebody's idea. I have copied things on CD into MP3 files because of ease of access. I don't try to sell it or spread it around online so it's ok." (High School)

Educators are aware of the challenges posed by these new technologies, but maintain that our current standards offline apply in the online environment. " Technology has made it so much more complex. There's the issue of sampling in music, are you going to footnote? It's done by serious musicians, classical musicians. It's hard to know where to draw the lines. Or using Photoshop and making something new out of it. That's serious art. How do you acknowledge that? We're in difficult water here. It was pretty clear about footnotes and books, but it's harder with more arcane technology. There's proper research and I think it's important that educators and parents teach the proper way to do research. We (teachers) have to define material that is correct."

In spite of these new challenges, educators emphasize the need to use traditional techniques. "That takes us back to old fashioned sources of good documentation, good references, how to check out something that might be fraudulent. It's harder now because it's click, click, click away. We need to ground kids in book culture until we know how to find our way in the new culture."

College students clearly articulate some of the complexities involved. For example, they suggest that it is "harder to see a victim with any online crime. It all started with cassette tapes. ...I mean nobody in their right mind actually thought ...I'm doing this horrible thing when they ...copied cassette tapes. And then you got the Internet and all of a sudden instead of just... copying cassette to cassette tape, you're copying CDs, you're copying books, you're copying art. Everything suddenly with the Internet went from a small issue to ...the point where you can copy entire movies, you can copy entire books in seconds. And I think our ethics weren't ready to expand. ...Anything I could copy in an hour wasn't that important." (College)

Students see the online environment as distinct from the offline world. They acknowledge that the way people interact with one another online adheres to different standards. "You act different when you're being ethical on the Internet, than when you are being ethical in real life." "I mean I'm not ON the Internet. There are parts of my life that I (am) showing through a website... ...you don't put forward your whole self. ...You're maybe an image of yourself, but not your real self. We can be more free with other people. We take advantage on the Internet." "I think basically what it is, is the Internet is just a lot less real to people than the real world. And that's why it's called cyberspace. It's not called the real world." "...people just don't think of the Internet as a real thing with real consequences." (College)

But more than just a place where inhibitions or even better judgement are left by the way side, students question the fundamental assumptions concerning what is right and wrong in cyberspace. When discussing intellectual property in the online environment, they explain: "it's like when you're a little kid you're told don't steal that book because it's his book. If you steal that book he can't use it. On the Internet, if you steal his book, he still has his copy of the book and now it's just you have a copy of the book too. ...the standard ethical rules you drive into little children just don't apply as much on the Internet as they do in the working order world that's out there in other places." (College) These same questions have been posed by philosophers at MIT (Ludlow, 1996).

To summarize, some issues are clear for both teachers and students. Other issues are not so clear when it comes to considering "appropriate" and "inappropriate" behavior online. Advances in technology create new challenges for ethical decision-making. While educators insist most cases are still a matter of "basic values," college students suggest that cyberrules are different.

Theme 4: Educators can encourage ethical behavior by recognizing the type of situations that make unethical behavior attractive and challenging students to channel their technological expertise in positive directions.

Educators are well aware that students have a great deal more technical knowledge than they do: "It will take all our brains and energy to keep up with them." But they are optimistic that most students want to do the right thing. They believe must establish clear examples of what's "right." "It's still a real minimal number compared to the whole. 98% do what's right 99% of the time. Kids who steal cars now and then. (The main) issue is being consistent and clear. This is appropriate and acceptable. It should not be a mystery. Let kids know. It really needs to be spelled out, taught, probably from kindergarten."

Students suggest that educators focus on the positive and keep the list short! "When you first sign up to AOL you get a 75 page email or so anyway, it's really long and you're supposed to read the whole thing long long thing (we were) so anyways if you read it there's 50 million rules and it's weird it's annoying also they never what they tell you what you can do, just what you can't do. It would be better if they sent the can dos and then you have a shorter list to read and you can picture the bad things." (Elementary/Middle)

Reinforcing ethical behavior requires educators to actively engage students in a dialogue. The younger generation learns by doing! "Past experience has a lot to do with it. Have to learn things the hard way, from experience. If people just tell you something you really have to see if for yourself." (High School) "You have to do it personally. You have to come to personal decisions or you can tell kids to do that themselves.... So I think that's one way that they interact." (College)

Educators recognize some situations make unethical behavior attractive and emphasize the importance of carefully evaluating expectations. "I think the pressures on them – they talk about how they have to perform at such a level in 10 different activities and be able to sleep two hours a night and be the king and queen… A lot of youngsters rationalize - 'I can get this done, I just need some help from cyberspace, a buddy, a friend, etc.' Either they don't see that or they do see and the pressure is so high. That's their way of meeting those demands placed on them. Especially in high school, starting in about 7th grade."

Still, there are those students who engage in unethical behavior just for the challenge. "It's a game to some people, you can't get caught, can't get killed, like a game or a test of their ability. "It's a challenge they need and the Pentagon is the ultimate challenge. Go to a more impenetrable challenge." "…For a lot they are kind of total losers in real life, (who) keep to themselves, (and have) no power... ...in cyberspace I have power. What a power trip hacking into the Pentagon. Kids with no friends. 'I beat the Pentagon hack protectors.' " (High School)

Finally, it is important that educators provide opportunities that challenge those students with technological expertise. By channeling their expertise in a positive direction, teachers can provide students with opportunities to take ownership and act responsibly. "One of the problems at my school is vandalism. They were taking the balls out of the mice. It gets really old. The Lab was inoperable... ...We talked to SGA (Student Government Association) to get the students involved... What are the consequences of this kind of vandalism? You're behind on your project because someone thinks it's funny, but you are burdened. Only faculty and staff were owning this problem. We asked them to help us deal with it. It's kind of like when I first started teaching. My father told me to find the biggest kid in the room and make him your friend. It was good advice. Find the smartest computer kid in the room, get help from them, help them resolve problems. …Sometimes they do it for the challenge - that's a good value, looking to explore new territory. Adults have to channel that into something constructive. ...That talent should be directed somewhere where it doesn't destroy property… …Channeling it... ...you (can) do a tech based project and have them help you teach the project. All of a sudden they have ownership and they aren't going to screw that up to lose the power or the satisfaction. They (the students) are teaching the teacher. (It's) called pride. You give them back to channel it. They were sitting there all day putting inappropriate pictures on the screen savers. Then you say can you put in some pictures of the Civil War, using the same skills. And citing, of course!" (Educators)

To summarize, educators can encourage ethical behavior by recognizing the type of situations that make unethical behavior attractive. In addition, it is important to provide opportunities that challenge students to channel their technological expertise in positive directions. Students who take ownership of their work are less likely to act in ways that are destructive to the online community.

Future Directions

At present, the most common response of educational institutions to the challenges of cyberethics has been to hand out an Acceptable Use Policy (AUP) and a set of plagiarism guidelines, require students and parents to sign it, and wait for the ball to drop. As this paper demonstrates, the questions these issues raise cannot be addressed by a single statement of principles, however well crafted. The answers are too varied and unclear for easy, unequivocal answers. No AUP can anticipate every possible problem that may arise. Instead of prescribing policy, students and educators need to establish an ongoing process of ethical discourse when dealing with cyberethics issues.

If we see cyberethics issues as more akin to other types of moral dilemmas, the research on moral education can provide us with some direction. Narvaez, Bebeau & Thoma (1999) noted that Rest's four stage model can be used to classify various approaches to moral eduation in K-12 schools. According to their analysis, moral education in the public schools historically tends to reflect society's particular moral concerns which have ranged from the "macromorality" concerns of the 1960s (the Civil Rights movement, anti-war protests) to current pre-occupation with attempting to curb perceived youthful antisocial aggressiveness by emphasizing self control and "10 Commandment" type prescriptions for moral behavior. Using the four component framework, this reflects a shift in emphasis from moral judgment to moral character. The effectiveness of current "character education" approaches has not yet been established (Leming, 1997 in Rest, et. al., 1999). It would seem logical that approaches that address multiple components of moral behavior should be more effective than those that address only one component. Thus, any approach to cyberethics education should address issues of moral judgment, moral character, moral motivation and moral sensitivity.

Insights from brain-based learning research (Caine and Caine, 1991) also can guide cyberethics education. This research indicates that students must connect what they are trying to learn with what they already know to retain the knowledge. Traditional presentations of instructional material organize that material into the educator's categories of knowledge. With a subject like cyberethics, this traditional approach is particularly unlikely to yield effective results since the student's categories of knowledge may differ quite significantly from those of the teacher.

Educators and students need to engage in dialogue that can help both groups question their decisions concerning the use of ethical standards. In this process it is important to recognize that everyone will not come up with the same answer or agree on a single "ethical" course of action. All can agree that decisions should be based on sound reasoning and ethical principles.

Where ethical standards can be applied, we need to document the harm of ignoring an ethical course of action. This can help students develop moral sensitivity and enhance moral motivation as they see the consequences of their behavior on what are usually perceived as "invisible" victims.

All of us --students and teachers together-- must actively question the changing boundaries that result from technology transfer. These questions cross many disciplines in the humanities and social sciences:

- How do students of different ages, developmental stages, and cultures grapple with "ethical" in the online environment?
- How are social boundaries changing and thus defining what is appropriate and inappropriate online?

- What social forces shape these definitions?
- How do economic and political pressures influence our judgments and behavior?

Using the interactive nature of the Internet itself may prove to be a very effective means of facilitating this kind of ethical discourse about online behaviors. The linear features of online technology allow students to select multiple paths through new material rather than one set, prescribed course of study. Digital "scaffolding" techniques can assist students as they apply abstract concepts to contemporary issues. Scaffolding refers to the guidance students are given while completing a complex task like ethical decision-making. Students are given only the amount of help that is needed, as that help is needed. The teacher gradually withdraws assistance, allowing the student to complete the task independently. Scaffolding is designed to support students through more complex tasks with the amount of support they need, and no more (Jonassen, Peck and Wilson, 1999). Using these techniques to engage students in brain-friendly ways, and addressing all aspects of the four-stage model described above should yield a rich, comprehensive approach to exploring cyberethics issues and developing students' moral sensitivity, judgment and decision-making capabilities.

The stakes involved in becoming a more ethical society online are not trivial. With our increasing dependence on computer technology for tasks as significant as maintaining medical records, controlling air traffic, ensuring national security, and conducting businesses large and small, the unethical actions of a few have the potential to impact society on a massive scale. Helping our students acquire the awareness, the motivation and the means to become ethical decision makers in cyberspace is critical in order to prevent such impacts from occurring.

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A Posthoc Review of Two Potential Communities of Practice

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Abstract

There is a growing interest among organizations in identifying and nurturing Communities of Practice. However, defining a Community of Practice, distinguishing it from a team, and nurturing the growth of a forming Community of Practice can prove to be challenging. By considering two case studies in a posthoc fashion, two potential communities of practice will be defined and characterized. Finally, a discussion of how best to nurture a newly formed community will take place.

Introduction

Delineating what is and what is not a Community of Practice (CoP) is not a clear-cut task. Although many definitions of Communities of Practice exist, assessing the degree to which a group meets the components that make up the criteria of these definitions is often subjective and difficult at best. One specific area of difficulty is distinguishing between a team and a CoP. Because there are strong similarities between the two, it is often helpful to outline the areas where teams and CoPs differ. A final area of difficulty with regard to a CoP is determining, if one does indeed exist, how best to nurture its existence in an effort to provide fertile soil for its development. This paper will look at these three areas: (1) defining a CoP, (2) distinguishing between a CoP and a team, and (3) identifying ways to nurture a CoP. The framework for addressing these questions will be from the perspective of a posthoc review of two case studies: the ISUnion Web-design Team and the actual virtual community developed by the Web-design Team. The purpose of the Web-design Team is to develop an electronic, web-based infrastructure to support the development of a virtual community of dialogue. The purpose of the virtual community is to nurture dialogue among existing practitioners, faculty and current students in the area of performance technology and instructional systems design.

The ISUnion is an interactive web site designed and created by graduate students of the Instructional Systems (IS) Program at an academic institution in the Southeastern United States. The ISUnion consists of components such as an interactive forum, news, a knowledge management/survey center and an employment center. The original goal of this web site is to build a virtual community of students, alumni and faculty to develop, improve and promote the IS Program at the institution. This website came into existence in September 2000.

Communities of Practice

Diverse definitions of Communities of Practice exist, yet they have many similar characteristics. The phrase "community of practice" was first used in 1991 by Etienne Wenger and Jean Lave. In 1998 Wenger published the work, "Communities of Practice: Learning, Meaning, and Identity" which describes communities of practice as a "community created over time by the sustained pursuit of a shared enterprise." Wenger further clarified Communities of Practice as "groups of people who share information, insight, experience, and tools about an area of common interest". (Wenger, 1998)

The Value of a Community of Practice

Why are communities of practice worth identifying and nurturing? They bring the power of a self-organizing, social entity to play in an otherwise often highly structure world. "Self-organizing" means that it is based on a degree of intrinsic motivation and perceived value. People are a part if the community because they want to be. When they no longer find value in the community, they either change the community or leave it. The fact that a CoP is a social entity brings the dynamics of the complexity and interrelations of two or more persons interacting. This relation is seen to be exponential in its power as opposed to linear.

Many organizations including business, government, and not-for-profits, have seen the potential of communities of practice. Organizations such as Hewlett-Packard, the Department of Defense and the World Bank have all developed technical means of supporting communities of practice. Often this takes the form of discussion boards or electronic data sharing.

Because of the change in our global economy from that of being an industrial society to that of an information sharing society, organizations see the value of capturing the knowledge that exists within communities of practice. Within knowledge management frameworks, organizations not only attempt to capture existing data and information, but they also see the value of capturing knowledge, expertise and wisdom. Today's workforce no longer places their loyalties with a single company. Whereas a few years back it was not uncommon for a worker to retire after thirty, forty or even fifty years with a single company, today, individuals value career moves. They develop specializations. Workers move to where the career opportunities allow them to increase their expertise. From the knowledge management perspective, organizations develop electronic forums for communities of practice to share their knowledge, expertise, and wisdom. Because of the electronic infrastructure, this is now archived information, a living artifact, which an organization can now index and search. When the individuals leave the organization, at least parts of their tacit knowledge has been captured by the organization.

But simply setting up a discussion board alone may not provide a nurturing environment for a community of practice to emerge. Communities of practice take time to form. They follow an ever-changing pattern of ebb and flow. Indicators that a community of practice has formed would include the nature of the structure, the commonalties and the artifacts or products of the community (Wenger, 1998).

A CoP is formed spontaneously as people seek help, try to solve problems, develop new ideas and approaches (McDermott, 1999). People's interest, time and energy direct their participation in CoP. A CoP develops in various stages with different levels of interaction among its members and different kinds of activities. A CoP is different from a business or functional unit in that it defines itself in the members' understanding of their practice. A CoP is different from a team in that it is defined by knowledge rather than by task. A CoP is different from a network in that it is not just about social relationships.

Communities of Practice are groups of people who share similar goals and interests. In pursuit of these goals and interests, they employ common practices, work with the same tools and express themselves in a common language. What keeps people together is a common sense of purpose and a real need to know what each other knows.

Members of a Community of Practice learn from each other in solving common problems and evolving a more skilled and creative practice. They are committed to jointly developing better practice. Communities of Practice are pivots for the exchange and interpretation of information. They leverage the preservation of tacit knowledge and keep up with the development of the cutting-edge technology.

Case One: The Web-design Group of the ISUnion Project as a Potential Community of Practice

The Web-design Group consists of twenty-five members who participate in varying degrees in the design of a webspace structure to support the potential, virtual community of dialogue. In reviewing the development of the infrastructure in a posthoc fashion, it is beneficial to outline the differences between a team and a community of practice. Several articles have been written to look at these similarities and differences and to determine how the strengths of each can best be utilized within an organization (McDermott, 1999 & Sharp, 1999). Figure 1 below presents key distinguishing differences between teams and communities of practice.

Characteristics	Team	Community of Practice
Existence	Appointed	Choose (self-organizing)
Orientation	Forward view	Sense of history
Define by	Abilities	Knowledge
Driven by	Goal	Value
Progress	Via workplan	Via discovery
Membership	Fairly stable	Transient

Figure 1. Alternative Views of Teaching and Learning, 2000

The structure of the Web-design group is based on outlined project plan and individual's abilities to move the project forward. While the group was self-appointed (volunteer), there was a strong marketing effort by core members, which included benefits of participation such as training on HTML coding and graphics applications.

The commonalties of the Web-design group included a shared vision for the desired outcome. However, the group was driven by the goal of completing the project. There was no desire for long-term sustainability of the design group. Rather, a workplan, which had a specific end point, was the driving force. While many shared stories, language and jargon were noticed, it is believed that this is in part due to the common environment of the participants. All were students within the same programs, attending classes with the same professors, and moving through the same track.

Finally, the products of the group related directly to the project. Whereas with a community of practice where the products tend to be a defining element, the Web-design group looked at the products as completion points. They did not define the group in any way.

Based on the activities, social dynamics and structure of the group, and nature of the group's products, the ISUnion Web-Design group could be considered a team rather than a Community of Practice. The social dynamic as it currently exists, is strong and with the strong core value of "perceived value in the idea of the ISUnion" shared by the group, the team will most likely develop into a CoP in time. However, as it currently stands, it would be better defined as a team with strong social interactions, a shared belief in the value of the project and a firm knowledge and trust of the abilities and skills of the other group members.

Case Two: A Virtual Community as a Community of Practice – The ISUnion

Is the ISUnion (Virtual Community) a CoP? While it may be too early to answer this question, the ISUnion is a potential CoP because its structure and the target interaction conform to the characteristics of a CoP.

Organizational / Social Structure:

Members of the ISUnion are students, alumni and faculty of the IS Program at a Southeastern United States academic institution. They are informally attached to one another through exposure to the common field of instructional design or improving human performance, and they are in common pursuit of solutions to improve human performance. They hold a warehouse of knowledge and skills in Instructional Systems and Human Performance Technology. Additionally, they come from the same institution, which provides a common theoretical underpinning for the study of the particular discipline.

But the ISUnion is different from a formal organization. People who participate are all doing it out of their common interest in solving human performance or learning problems, and they all speak in the ISD jargons like " instructional objectives and learning hierarchy". Their motivation to participate is intrinsic as no reward or incentive system exists to encourage

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participation. People build friendships and learn from each other at virtual and face-to-face social occasions in the format of chatting, sharing experience and story telling.

Roles of Participants in the ISUnion from the Perspective of a Community of Practice

Wenger describes several roles of an individual within a community of practice. The are:

- Inbound
- Insider
- Outbound (Wenger, 1998)

"CoPs arise out of people's natural desire to share ideas, get help, learn about new ideas verify their thinking, and hear the latest "professional" gossip" (McDermott, 1998). They develop as people have regular contact with people who share their interests.

Newcomers of a CoP usually take an "observational" lookout post, both absorbing and being absorbed in the culture of the community of practice. They assemble a general idea of what constitutes the practice of the community. Their tasks are usually short and simple with small costs of errors and little responsibility. Newcomers usually perform at the end branches of work processes and start from the ground for self-evaluation (Lave & Wenger, 1991).

How does this description relate to the role of a newcomer in the ISUnion? People reach out to the ISUnion from different angles. People may have heard about the ISUnion from their department listserv, available flyers, or by word of mouth. They begin with observing, which is to check out news first, to see what is going on out there and what the web site has to offer to its target audience. Then, they will lurk on the discussion board, and jump in whenever they feel interested or have time to join the discussion if they feel that the discussion facilitated by the ISUnion is of value to them for their professional development.

"Inside" community members frequently help each other solve problems, offer each other advice, and develop new approaches or tools for their business or study. Helping each other makes it more convenient for community members to improve their weaknesses and learn together in the "public space" of the community (McDermott, 1998). "As they share ideas and experiences, people develop a shared way of doing things, a set of common practices and sources of individual identify" (Lave & Wenger, 1991).

As a member at full participation, insiders usually have a deeper sense of the value of participation to the community. Learning of an insider lies in becoming a part of the community. Insiders commit a greater amount of time and an intensified effort. They assume more and broader responsibilities and take more risky and difficult tasks. They enjoy an increasing sense of identity as a master practitioner (Situated Learning, 1991).

People enter the ISUnion to check out news regularly, to share experience bravely and to search for answers to their unsolved problems. People participate in the ISUnion can perform similar jobs or collaborate on a shared task or work together on a product. Maybe some of them work together at the same company or in the same classes, maybe some are working on a mutual assignment. They are peers in the execution of the real work. What holds them together is a common sense of purpose, which is to improve their ISD practice, and a real need to communicate what each other knows in order to broaden their insights and vision in the ISD field. They ask each other for advice on completing their ISD projects, they share successful or painful experience in past projects and discuss about the direction of development in the ISD field.

Students talk about their accomplishments and concerns, and express their expectations and ambition for our program. Alumni share stories of their practice in the field or make known their admiration and loyalty for their alma mater reflecting on the foundation they built while there, and helping to strengthen our current program by sharing their information, experience and talent in the IS field. Faculty members maintain a close connection with students and alumni for a common purpose, to express their thoughts on a program they greatly influence (ISUnion Proposal, 2000). At the same time, more experienced and well-respected alumni or faculty members can act as thought leaders or coordinators of the CoP to initiate activities and guide the direction of people's interactions.

A community of practice is a living entity, in a "constant state of motion"; evolution. As such, people move towards the edges of the community, following an outbound path towards the ever-changing boundary "defining" the community of practice from the outside "world". There are several reasons why a member of a CoP would be on an outbound path. These include:

- Conflicts or shifts in time and energy
  Since CoP is not an official required organization for people to join, people's participation in a CoP depend on their individual commitment of time and energy. Even though participating in CoP is valuable to people, it is easily ignored because of other more pressing tasks (McDermott, 1999). Also, if a person's energy level does not allow him to attend any CoP activity after work, this person will very likely to choose to rest for next day's work instead of going for a CoP meeting.
- Conflicts or shifts in values
  Another important issue that caused people to leave a CoP is the conflict or change in the value of an individual and the shared value of a CoP. Sometimes, a community member joins a CoP when his or her temporary needs or value match the CoP value. After a while, his or her needs or value may shift according to the change in his or her situation such as a job shift. This person's value may not match the one of the CoP any more after he or she changed his or her job, and he or she will choose to leave the previous CoP, or maybe join another CoP.
- CoP not engaging or effective enough to hold people together
  Because of the emergent and spontaneous nature of a CoP, sometimes it is not well organized or managed efficiently. If the CoP activities are not focused on knowledge and skills essential to both the practice and the people; if there is no

respectable community members or thought leaders involvement or coordination; if personal or community interactions are not active or enthusiastic, community members will lose interest in the CoP activities and the CoP is going to diminish. Specific to the ISUnion, potential reasons why people would be on an outbound path are:

- Not enough involvement
  It is possible that people will leave the ISUnion if it does not have enough opportunities for individual or community interaction. Most people would not like to participate if they see very few people interact with each other, and there are no major professional figures (experts) within the participants. They would consider that this CoP is not very popular among the practitioners in the ISD field, and guess that there might be less value in committing time and energy to this CoP.
- Not active or current
  It is likely that people will stop observing or lurking on the ISUnion if they find out that there is not much change in the topics or feedback of the discussion forum, or the number of hits to the web pages have very slow and slight increase. They would think that the topics discussed on this web site is not related to the most current core value so that nobody would like to contribute.
- Not entertaining
  Due to the self-emergent and self-organizing nature of a CoP, the stability of the community can easily deteriorate if the contents or activities provided by the ISUnion are not attractive enough to hold its visitors for a comparatively long period of time. It will be very difficult for a member of the ISUnion to have to discipline him- or herself to keep coming back to visit the web site if there is not any fun or interesting elements related to the field, which appear on the web site regularly and frequently.
- Time and energy
  Some people may have to stop attending the ISUnion temporarily or permanently if their job, study, or personal load does not give them any space for any other commitment. For example, there is a fluctuation in the number of hits to the ISUnion between ordinary school days and the week for the final exam because most of the participants are working in the educational area.

What are the potential benefits of a CoP?

Communities of Practice provide an opportunity for people to solve real problems in ways that formal processes can not anticipate. There is always a formal ideal way of performing a task or completing a study assignment such as Service Standards or the requirement on a course syllabus. But after we do things in the real settings for a period of time, we may have pulled out from the Service Standards or syllabus a gist of the ideal way or have formed our own thoughts or experience of performing the task. This set of informal or improvised knowledge is what we can share with each other within a Community of Practice to become an efficient and skillful performer of our tasks, but what we can not always obtain from formal education or instruction.

Learning is more about becoming a member of a community than it is about absorbing information. It is considered a social process built around informed participation. This applies to the learning of tacit knowledge, which refers to "intuition, judgment, and common sense—the capacity to do something without necessarily being able to explain it". Tacit knowledge exists in the special practices and relationships that emerge from working together over time. People draw out the tacit knowledge that others possess by having human interactions to construct a common context to understand each other and the trust to be willing to share ideas. (Brown & Gray, 1995)

Why do people want to join ISUnion and Can we benefit from ISUnion ?

- The ISUnion is a badge of identity.
  People who participate in the ISUnion identify themselves as a current or previous member of the IS program and the field. These people will be interested to find out about what happened in the program, what progress the program has made and what the most up-to-date research or development is in the program and the IS field. The perceived quality of the program is a reflection on all past, present and future participants in the IS Program.
- The ISUnion is a place to meet people.
  People involved in the ISUnion activities are the ones who really would like to meet (may be virtually) with other people working or studying in the same field, and to form a social relationship with them. Now more than ever, people realize the importance of networking with people working in the same field. They try to improve their learning and collaboration by building trust between each other first. For this purpose, they will actively take part in most of the activities proposed by the ISUnion for them to meet people face to face or virtually. An additional benefit of the ISUnion is the forming of a web of participation and networking. The ISUnion web site presents the most current news of events happened in the IS program. It is updated every month with the most recent stories of events and photographs. People come to the ISUnion to read about what has just happened and what is going to happen so that they can share the common topics when they encounter other members of the community. People get together face-to-face when there is any conference or social event announced by the ISUnion, and these events become the major "real" (as opposed to virtual) human interactions of the CoP.
- ISUnion is a way to learn.
  Another major reason, hopefully the most important one, for people to be engaged in ISUnion is to learn from each other and to produce better practice. The discussion topics posted on the interactive forum can be a big attraction to the target audience. People can raise their questions or problems by posting them into the forum. If other people find the topics interesting and relevant to their particular problems or experiences, they would try to offer solutions or share their similar encounter by carrying out an asynchronous on-line discussion. Other members who visit the web site may also regard this

exchange of information valuable to their job or study. Thus, learning will be disseminated within the whole group of target audience.

The ISUnion offers an alternative way to learn about the real work experience from alumni and faculty members, about how academia relates to "reality" and how the combination of theory and practice is dynamic in nature. Summaries of interviews of alumni and faculty posted on the web site inform us about stories of achievements and failure. These real-world stories may be different from the ideal settings and methods learned from the courses offered by the IS program. These stories provide us with a context to connect classroom study with the real-world requirements, and create a more realistic view of the ISD field. Conversely, a theory "worked out" on the web site via dialogue may have a change effect on a current practice in the field.

Via the ISUnion, we have the opportunity to learn what is impossible for the academic IS program to offer--- the tacit knowledge by becoming a member of the community. The tacit knowledge that is embodied by the community of the ISUnion refers to the intuition, judgment and common sense serving the purpose of improving human learning and performance. This tacit knowledge can only be acquired by involvement with the students and practitioners in the ISD field. The ISUnion offers us one more opportunity to interact with these people and to have one more exposure to and possibly working with this embedded knowledge.

Nurturing the Community

Having demonstrated that the community for which the ISUnion is serving is in fact a community of practice, and that there is a potential benefit to the community for using ISUnion, we must now determine how to increase its use. At present we have identified four areas of potential improvement. The four areas that are currently lacking are involvement, interaction, time/energy, and entertainment.

Involvement, for our purposes, is defined as communication between community members. Some possible ways to increase involvement are storybuilding, case debates, and increased discussion. Storybuilding would consist of individuals 'writing' a collective story. A second proposed technique is sponsorship of case debates. The concept is to post elements of an instructional or performance analysis and allow community members to discuss and debate subsequent actions. A final proposal to increase involvement is to increase activity on the discussion board. A couple of ideas in this area are to have recognized leaders and experts in the field moderate discussions and to restructure the mechanics of the discussions so that they are not linearly structured.

Interaction, for our purposes, is defined as utilization of the site. Examples of ideas to increase community use of the site are a case study database, electronic library, day-in-the-life-of documentaries, and daily updated material. A case study database could be a repository of cases studied within the classroom, experienced in the Performance Systems Analysis course, and encountered by alumni. Such case studies would include as many elements as possible from the initial contact hopefully through a complete evaluation. Such a repository would be of immense benefit for many different members of this community, from students learning the processes for the first time to veterans of the field doing research. A second idea to increase the member interaction would be to digitize current videos from the Learning Resource Library. Such videos represent seminars with leaders of the field as well as recorded courses. Other material could also be added to the library, such things as lecture notes, PowerPoint presentations, and old tests. Another element for increasing interaction could be documentaries of leaders in the field and alumni of the program. A final idea is to have daily "___'s". This could be a daily quote, daily word, daily wisdom, and etceteras.

Time and energy seem to be in short supply for many members of this community. As such, this site should help reduce time and energy expenditures of the community members. Some ways to accomplish this could include posting projects from the Computer Courseware and Electronic Performance Support Systems classes that might be of benefit to the community. Such courses could include accessibility requirements, copyright laws, and software introductions. Instructors can use the site within courses. An example of such use might be to interview alumni online. Interviews are currently a requirement in one course, by conducting them online there is a record which others can benefit from. Furthermore, course credit could be given for work done on the actual site. The program that supports the site is not very strong technically and some students feel this is a deficit with the program. By providing credit for technical work on the site, the site, the student, and the program gain some benefit. A final method to reduce time and energy consumption is to use the site discussion board. At present the online courseware supports discussion but does not provide a notification option. The ISUnion discussion board does provide this option.

Finally, the site could be made a bit more entertaining. This could be accomplished through the use of such elements as jokes, comic strips, and interactive games. There could also be a ___-cam. This would be something along the lines of a fish-cam, but with an object of interest to the community.

All of these potential methods of nurturing the community are technical and require deployment time. Many of them also require a repository in place prior to deployment. Several also require individuals to commit to moderating discussions or provide material. However, much of the material does exist or would not require much effort to prepare for the web. The question that must be answered is whether the extra effort provides a large enough benefit to the community to be worthwhile.

Conclusions

A Community of Practice takes time to develop. Communities of Practice are organic and self-organizing. They need time to find what kind of information to share, who the participants are and the "best" methods to communicate (McDermott, 1998). For example, McDermott mentions the experience of Shell's Corporation with the nurturing of successful communities of practice. They started with a group of six to eight people meeting weekly to discuss some technical issues. It took them six months for word to spread of the value of these discussions. Then the number of people that attended the weekly meetings increased to about forty.

ISUnion is created as an intentional community of practice, which is "intentional in its focus". But to develop the trust, connection and sharing of natural communication, it is necessary to support the natural process of community development instead of imposing an artificial one (McDermott, 1998).

Are these two entities of the ISUnion destined to be communities of practice? Only time will tell.

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Increasing Preservice Teachers' Capacity for Technology Integration Through Use of Electronic Models

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Abstract

Current teacher educators are being challenged to find opportunities for their preservice teachers to develop both competence in, and confidence for, integrating technology into their curricula. Given the difficulty involved in trying to arrange successful classroom technology experiences for preservice teachers, this study was designed to examine whether electronic models of exemplary technology-using teachers, presented via CD-ROM, could provide a viable alternative for developing ideas about and self-efficacy for technology integration. Sixty-nine students enrolled in a one-credit technology course completed demographic and online survey instruments before and after interacting with a CD-ROM that featured six teachers' classroom technology beliefs and practices. Results suggest that electronic models can significantly increase preservice teachers' ideas about and self-efficacy for technology integration. Furthermore, students' found the examples of teachers included on the CD-ROM to be both realistic and relevant. Implications are discussed as well as suggestions for future research.

Introduction

According to the most recent report of the National Center for Education Statistics (NCES, 2000), nearly 70 percent of teachers report not feeling well prepared to use computers and the Internet in their teaching. The 1998 Technology in Education Report (Market Data Retrieval) noted that only 7 percent of schools, nationwide, boast a majority of teachers at an advanced skill level (i.e., able to integrate technology into the curriculum).

Even among our newest teachers, instructional use is not as high as might be expected. Contrary to popular belief, preservice and beginning teachers do not use computers significantly more than their more experienced colleagues (Hadley & Sheingold, 1993; NCES, 2000; Sherwood, 1993). Although beginning teachers report *wanting* to use computers, and have gained adequate technical skills, they typically lack knowledge about how to integrate computers within the more routine tasks of teaching and managing their classrooms (Hruskocy, 1999; Novak & Knowles, 1991).

Skills vs. Ideas

Clearly, the growing increase in teachers' technical skills is insufficient to guarantee the effective use of technology in the classroom (Carvin, 1999; Marcinkiewicz, 1994). In order to translate skills into practice, teachers need specific ideas about how to use these skills to achieve meaningful learning outcomes under normal classroom conditions. Traditionally, inservice technology training programs have been software- rather than curriculum-based (Gilmore, 1995). Thus, teachers completed technology courses still not knowing how to create or implement small- or whole-group activities that incorporated meaningful uses of technology (Moersch, 1995). Unfortunately, this also has been true for most teacher education technology courses (Moursund & Bielefeldt, 1999; Yildirim, 2000). Although the majority of teacher preparation programs now require that students take three or more credit hours of technology instruction, recent survey data suggested that most teacher education faculty still do not feel that technology use is being effectively modeled for our future teachers (Schrum, 1999).

Simply stated, few of our current or future teachers have either observed or experienced learning with or from computers (Carlson & Gooden, 1999). While today's teachers are expected to leverage the full potential of powerful conceptual technology tools to meet the changing needs of their students, they have been given few, if any, opportunities to develop their own visions for, or ideas about, meaningful technology use.

The importance of developing a vision for technology use cannot be overstated (Ertmer, 1999). As noted by the Office of Educational Research and Improvement (1993): "Most teachers will find little incentive to tackle the technical and scheduling problems associated with technology unless they have a clear vision of how the technology can improve teaching and learning" (p. 83). Once a clear vision is in place, specific tools and strategies are needed to help teachers address the many unique challenges posed by the translation/integration process: changing roles of teachers, students, and technology; classroom organization, management, and security issues; and assessment methods, among others. As Dexter, Anderson, and Becker (1999) explained, "For teachers to implement any new instructional strategy, they must acquire new knowledge about it and then weave this together with the demands of the curriculum, classroom management, and existing instructional skills" (p. 223). Teachers need information about how, as well as why, to use technology in meaningful ways. Lack of knowledge regarding either element can significantly decrease the potential impact that these powerful resources might have on student learning.

Self-efficacy Beliefs

Yet even the best ideas about technology use will remain unused unless teachers believe that they are capable of implementing them in the classroom. In particular, teachers' beliefs about their *ability to use computers* in instruction may be key, given the role self-efficacy is proposed to play in determining behavior. According to Eachus and Cassidy (1999), "self-efficacy has repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers" (p. 2).

Self-efficacy refers to personal beliefs about one's capability to learn or perform actions at designated levels (Bandura, 1997). According to Bandura, self-efficacy is based, not solely on the level of skill possessed by an individual, but on judgments about what can be done with current skills. That is, self-efficacy comprises beliefs about what one is *capable* of doing, not about whether one *knows* what to do. As such, self-efficacy is thought to mediate the relationship between skill and action. Therefore, without knowledge or skill, performance isn't possible; yet without self-efficacy, performance may not be attempted. According to Bandura, "beliefs of personal efficacy constitute the key factor of human agency" (p. 3). Thus, teachers who have high levels of efficacy for teaching with technology are more likely to participate more eagerly, expend more effort, and persist longer on technology-related tasks than teachers who have low levels of efficacy.

If self-efficacy beliefs are key to performance and increased self-efficacy can lead to increased performance (Christoph, Schoenfeld Jr., & Tansky, 1999; Schunk, 1981), how can we help teachers increase their efficacy for technology use? Researchers in the area of self-efficacy (Bandura, 1997; Schunk, 2000) describe four primary sources of information that can influence judgments of efficacy: personal mastery (successful task completion), vicarious experiences (observing models), social persuasion ("I know you can do this!"), and physiological indicators (emotional arousal, relaxation).

Next to personal mastery, vicarious experience is thought to provide the most valid information for assessing efficacy (Schunk, 2000). According to Olivier and Shapiro (1993), "vicarious experiences with the computer increase one's feelings of control and confidence. These encounters also make an individual want to learn more about the technology, thus reducing and eventually eliminating the fear of the unknown factor. As the fear and anxiety diminish and positive experiences add up, self-efficacy and the willingness to cope with mastering the task will increase" (p. 83). Given the logistical difficulties involved in providing preservice teachers with enactive experiences related to successful technology integration, teacher educators have turned to modeling as a feasible, yet powerful method for increasing teachers' ideas about and self-efficacy for technology integration (Schrum, 1999). Not only can models provide information about *how* to enact meaningful technology use but they can increase observers' confidence for generating the same behaviors. Furthermore, providing access to multiple models increases both the amount of information available about how to accomplish the performance and the probability that observers will perceive themselves as similar to at least one of the models (Schunk, 2000), thus increasing their confidence for also performing successfully.

Electronic Models

Still, the use of models does not guarantee either learning or later performance. Many factors have been shown to influence observers' responses to models including the prestige and competence of the models, consequences experienced by the models, perceived similarity of the models to the learners, as well as learners' own self-efficacy for performing the behaviors (Schunk, 2000). In addition, research has yet to establish whether models, presented electronically, can be used to achieve results similar to those achieved with live models. Will learners perceive themselves as similar to models that are presented electronically? Will they regard the models as both realistic and relevant? Given the increasing potential to present models of exemplary technology use via multimedia technologies, it is important to determine the extent to which pre- and inservice teachers can benefit from observing these types of electronic models.

Purpose

This study was designed to examine the effects of electronic models on preservice teachers' perceived ideas about, and self-efficacy for, technology integration. Specifically, exemplary technology-using teachers were presented via a CD-ROM teacher development tool, called VisionQuest. VisionQuest features the classroom practices of six k-12 teachers and is designed to support users' reflections on both the underlying beliefs and classroom strategies that enable exemplary technology use. Given the few opportunities preservice teachers have to observe exemplary technology use in actual classrooms during student teaching or observation sessions (Carlson & Gooden, 1999; Vannatta & Reinhart, 1999), VisionQuest was developed to provide these opportunities. Specifically, the research questions guiding data collection and analysis included:

- What effect does observing exemplary technology-using teachers, presented electronically, have on preservice teachers' perceptions of ideas about technology integration?
- What effect does observing electronic exemplary technology-using teachers, presented electronically, have on preservice teachers' perceptions of self-efficacy for technology integration?
- What are students' perceptions of the use of electronic models for learning about technology integration?

Methods

A pretest-posttest research design was used to examine increases in preservice teachers' ideas about, and self-efficacy for, technology integration following two 50-minute class sessions in which students used VisionQuest, a CD-ROM teacher development tool designed to present exemplary models of classroom technology use. Participants' perceptions of their learning experiences were collected via classroom observations and interviews with 10 purposefully selected students. Both quantitative (paired t-tests) and qualitative (pattern seeking) analysis methods were used to examine the extent to which electronic models offered a viable method for increasing preservice teachers' capacity for technology integration.

Role of Researchers

The research team consisted of a faculty member and five students enrolled in an advanced educational technology research course at a large Midwestern university. Students had varied background experiences, in both K-12 and post-secondary classrooms, and were seeking masters (*n* = 1) or doctoral degrees (*n* = 4) in educational technology. The team worked collaboratively to design the study and develop appropriate data collection instruments. Each researcher collected survey, interview, and observation data from students in one of the six course sections participating in the study. Survey data were combined and analyzed by the team; interview and observation data were used primarily to triangulate quantitative results.

Description of Site and Participants

Of the 103 students enrolled in six sections of an undergraduate educational technology course, 69 students signed a consent form and completed all three data collection measures needed for the study. *Classroom Applications of Educational Technology* is a one-credit optional course offered as a "companion" to the required 2-credit introductory course. Participants ranged in age from 18-34 years, with a mean of 20 years. The majority of the students were female (65%), sophomores or juniors (71%), and majoring in Elementary Education (60%). Eighty-seven percent of the participants had computers at home and, at the time of the study (week 10 in the semester), indicated that they used computers primarily for word processing (98%), electronic mail (99%), and browsing the Internet (98%). When asked to rate current levels of computer skills, from novice to advanced, 75% of the students rated their skills at an intermediate level while 9% rated themselves as beginners; 16% rated themselves as advanced. None of the students rated themselves as novice users.

Description of VisionQuest

As an instructional tool, VisionQuest (VQ) is designed to provide opportunities for users to explore models of effective technology integration. Users examine the steps that three sets of teachers have taken to achieve their current levels of technology use. Cases include a high school team of three biology teachers, a middle school music teacher, and an elementary team of two second-grade teachers at a science and technology magnet school. Users examine how teachers' pedagogical visions of classroom practice have shaped their integration journeys including how they got started, the roadblocks and challenges they faced, as well as the incentives that moved them forward (highlighted by the Roadmap components of Figure 1). The cases illustrate that technology integration can be successfully achieved in a variety of contexts despite differences in settings, resources, and student backgrounds. Users examine, both within- and across-cases, the relationships among teachers' beliefs (related to classroom organization; the role of the teacher, students, and technology; curricular emphases; and assessment practices) and current classroom practices related to technology (illustrated by the Path and Destination components of Figure 1).

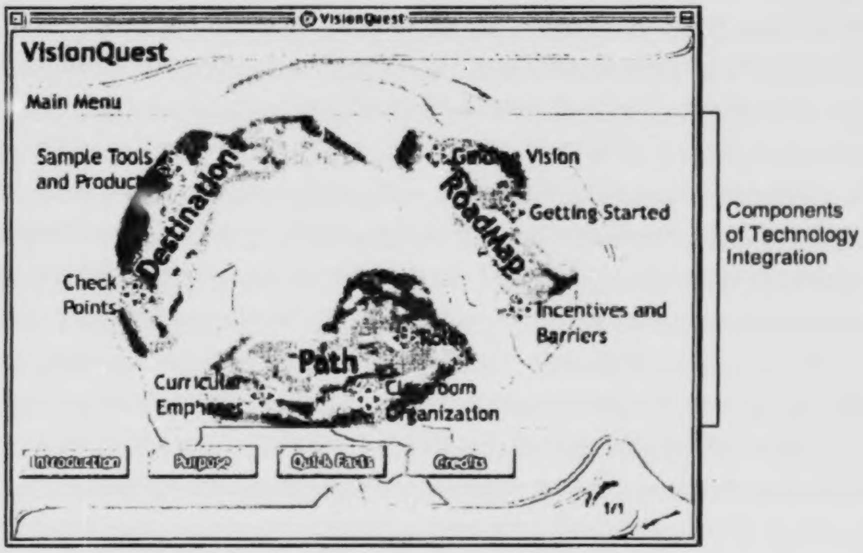

Figure 1. Screen shot from main menu depicting 7 components of technology integration.

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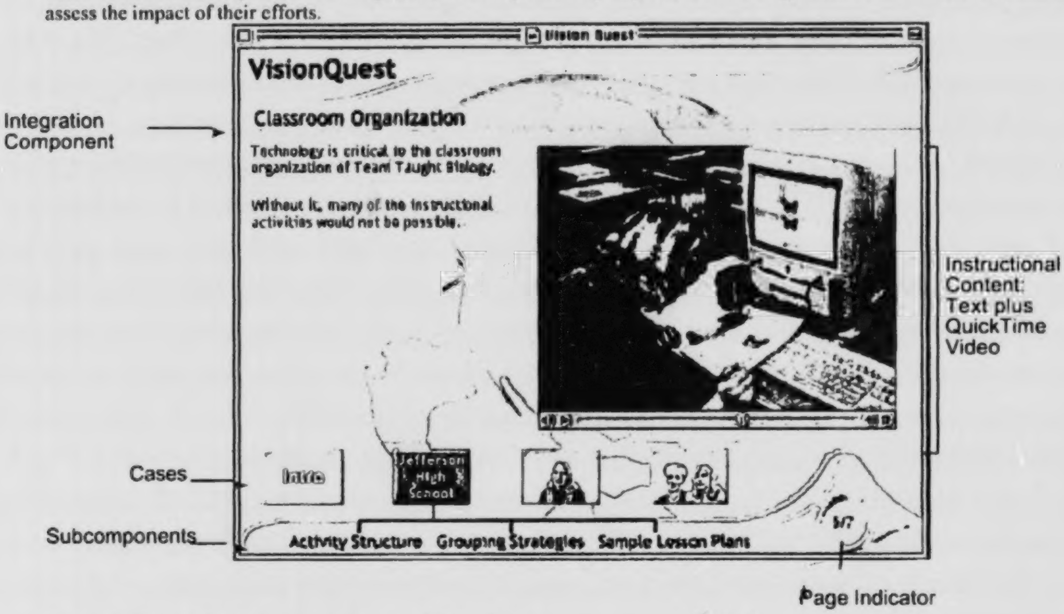
VisionQuest initiates user reflection through the use of video segments, augmented by electronic artifacts (lesson plans, student products) from teachers' classrooms. Cases are constructed such that users can explore teachers' classrooms either one at a time (case by case) or thematically (i.e., comparing components of technology integration across cases). Each case contains a variety of elements that combine to illustrate how teachers' visions for technology use are translated into practice (see Figure 2). Users examine how teachers planned for integration, how they currently implement technology within their classrooms, and how they assess the impact of their efforts.



VisionQuest

Classroom Organization

Technology is critical to the classroom organization of Team Taught Biology.

Without it, many of the instructional activities would not be possible.

Figure 2. Screen shot from a content page of VisionQuest.

At the time of the study, VisionQuest was in beta format. Although navigational features were still somewhat rudimentary, "workarounds" were built in so that students could effectively use the software to complete the tasks assigned.

Procedures

Demographic information was collected from the participants during the first class session of the semester. During weeks 10 and 11, as part of their normal class activities, all students worked with VisionQuest, completing two different tasks. During the tenth week, students evaluated VisionQuest as an example of professional development software. During this week, questions were specifically directed toward software quality and not software content. Although the majority of these data are not relevant to this study, two questions provided information about students' perceptions of the VQ models and will be discussed later. Students focused on content the following week when they used VisionQuest as a modeling tool to examine the beliefs and classroom practices of the teachers included on the CD-ROM. Students were asked to describe how the different teachers prepared their classrooms for technology use, how they used various grouping strategies to manage their rooms, how they managed classroom "chaos," and so on. At the end of this session, students were asked to list the components of classroom organization that the three groups of teachers had considered prior to implementing technology in their classrooms.

Data Collection

At the beginning of the tenth class session, prior to evaluating VQ, students completed an online survey designed to collect three types of information. First, information was collected regarding students' computer ownership, current use, and perceptions of skills and comfort using computers (e.g., "I enjoy working with computers." "When using computers, I can deal with most difficulties I encounter."). Eight items comprised this initial section. The second section included seven items regarding students' *ideas* for technology use (see Figure 3). Items were presented in a Likert-style format; students were asked to rate their level of agreement (from 1-strongly disagree to 5-strongly agree) with statements related to the possession of specific ideas regarding technology use. The third section used the same seven items as the second section but with an emphasis on the possession of *confidence* rather than ideas (e.g., "I am confident I can use one computer effectively during large group instruction." "I am confident I can use technology effectively to teach content."). Students used the same rating scale (from 1-strongly disagree to 5-strongly agree) to record their levels of confidence. Students' responses to the online surveys, prior to using VQ, comprised pretest measures of students' perceived ideas about, and self-efficacy for, technology integration.

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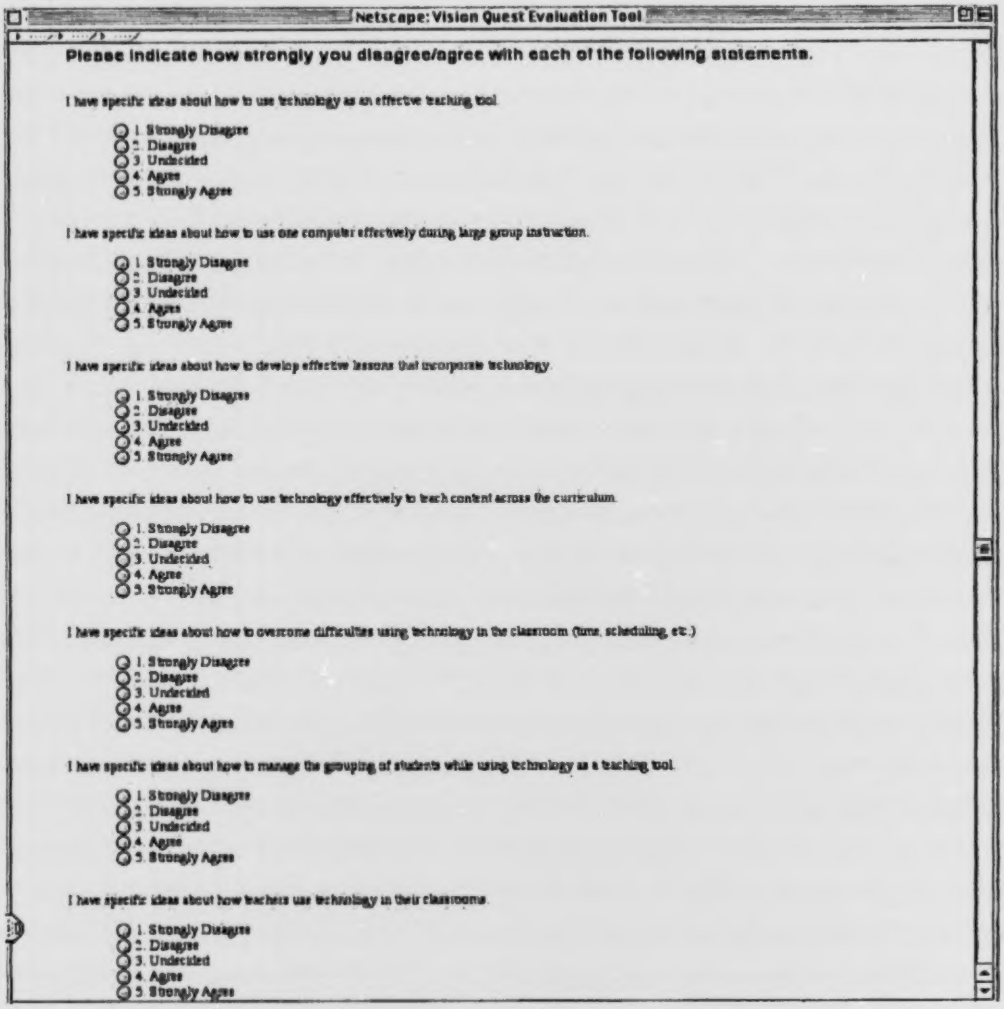

Netscape: Vision Quest Evaluation Tool

Please indicate how strongly you disagree/agree with each of the following statements.

I have specific ideas about how to use technology as an effective teaching tool.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how to use one computer effectively during large group instruction.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how to develop effective lessons that incorporate technology.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how to use technology effectively to teach content across the curriculum.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how to overcome difficulties using technology in the classroom (time, scheduling, etc.)

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how to manage the grouping of students while using technology as a teaching tool.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

I have specific ideas about how teachers use technology in their classrooms.

○ 1. Strongly Disagree
○ 2. Disagree
○ 3. Undecided
○ 4. Agree
○ 5. Strongly Agree

Figure 3. Screen shot from online survey: Ideas about Technology Integration Survey

At the end of the eleventh class session, after students had explored the ideas presented by the models on VQ regarding classroom management strategies, they completed the second and third parts of the online survey again. These measurements served as posttest indices of students' perceived ideas about, and self-efficacy for technology integration. In addition, four items were included to explore students' perceptions of using VQ as a modeling tool (e.g., "I can relate to the examples of teachers shown in VQ." "I can relate to the examples of technology shown in VQ.").

During both class sessions in which students interacted with VQ, one or two researchers were in attendance, making observations of students' engagement with the software. Observations provided evidence of the "holding" quality of the software and also provided useful information for the selection of interviewees. Students were purposefully selected for interviews (one or two per section) based on noted levels of interest, with an attempt to choose one highly- and one less-engaged student from each section. Interviews were scheduled at a time convenient to each participant and were audiotaped and transcribed by the interviewer. Interviews focused on identifying specific ideas (about classroom organization, assessment practices, etc.) that students gained from VisionQuest and the extent to which they thought they would use these ideas in their classrooms. We were particularly interested in knowing whether students regarded the VQ models as "real" and whether they believed that they had learned from them, just as they might learn from live models.

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Data Analysis

Demographic data were tallied and percentages calculated to identify general characteristics of participants. Changes in students' perceptions of their ideas about, and self-efficacy for, technology integration were determined using paired t-tests. Pearson correlations were calculated to determine relationships among ideas and confidence (pre and post) and specific demographic characteristics.

Interview transcripts were analyzed using a simple pattern-seeking method to determine students' impressions of the software and the impact it may have had on their ideas and confidence. Analysis efforts focused on comments that either supported or negated quantitative findings in order to validate, extend, or modify initial results. In addition we examined students' perceptions of using electronic models to determine whether this type of modeling tool might present a reasonable alternative to observing live models.

Issues of Validity and Reliability

Reliability was increased through the use of consistent data collection methods. Students in all six sections of the course completed the same online surveys--data were electronically transferred to an Excel spreadsheet, thereby eliminating possible error in entering or organizing the data. Each researcher followed the same procedures while introducing the study, conducting observations, and interviewing participants. In addition, weekly online and in-class discussions among the researchers increased the consistency of research methods used.

Chronbach's alpha was used to measure the internal consistency of the survey instruments. Calculated Chronbach's alphas were .80 on the Ideas survey and .89 on the Self-Efficacy survey, suggesting that the instruments were moderately reliable. Despite the fact that the same measures were used for both pre- and post-assessments, the possibility of experiencing a testing effect is minimal. According to Bandura (2001), previous tests for reactive effects have demonstrated that self-efficacy does not increase as a mere function of assessing one's efficacy: "If merely recording a level of efficacy made it so, personal change would be trivially easy" (p. 6).

Survey measures were evaluated by an expert in the area of self-efficacy and modified based on his suggestions, providing the instruments with a certain amount of face validity. To further increase validity, multiple data sources were used to triangulate findings. For example, observations provided a rough measure of students' levels of engagement, interview comments verified their excitement about the software, and survey measures indicated that students found the VQ examples relevant. Together, these data provide strong evidence of students' engagement in, and identification with, the models provided on VQ and as such, helped us answer our third research question.

Results

Changing Ideas and Efficacy for Technology Integration

A two-tailed paired t-test ($df = 68$) indicated a significant increase in students' ratings of perceived ideas about technology integration ($t = 8.85$; $p < .0000$) from pre- to post survey. Students' judgments of their ideas for technology integration increased from a pretest mean of 3.72 ($SD = .44$) to a posttest mean of 4.12 ($SD = .40$).

A two-tailed paired t-test ($df = 68$) also indicated a significant increase in students' ratings of perceived self-efficacy for technology integration ($t = 3.46$; $p < .000$) from pre to post survey. Students' judgments of confidence increased from a pretest mean of 3.84 ($SD = .52$) to a posttest mean of 4.05 ($SD = .47$).

Since it is fairly easy to achieve high correlation coefficients with larger samples, significance levels were set relatively high in order to discount high coefficients that were not meaningful. That is, we did not consider coefficients to be significant unless the probability of occurrence was less than $p = .0005$. Thus, based on a critical r value ($df = 66$) of .35, correlations among demographic characteristics and pre- and post- ideas and self-efficacy indicated no significant relationships among age, gender, or year in school (freshman, sophomore, etc.) and ratings of computer skills, ideas, or self-efficacy (see Table 1). Although one might expect advanced college students (e.g., juniors and seniors) to have more skills, ideas, or confidence, this was not the case in this study. Furthermore, there were no significant relationships between gender and any variables examined in this study.

Table 1. Correlation Coefficients among Selected Demographic Variables and Pre/Post Measures of Ideas and Self-Efficacy

	Age	Class	Gender	Computer Skills	Pre Ideas	Post Ideas	Pre SE	Post SE
Age								
Class	.73							
Gender	.18	.14						
Computer Skills	-.15	-.13	-.02					
Pre Ideas	-.09	-.09	-.12	.34				
Post Ideas	-.19	-.14	-.09	.28	.61*			
Pre SE	.05	.02	-.10	.18	.72*	.52*		
Post SE	-.14	-.09	-.12	.26	.48*	.84*	.50*	1.00

* p < .0005
Note: SE = self-efficacy

Significant correlations were found between students' perceptions of their ideas for technology integration, before and after using VisionQuest ($r = .61$); similarly students' perceptions of self-efficacy for technology integration ($r = .50$) were significantly correlated before and after using VisionQuest. Additionally, perceptions of ideas and perceptions of confidence were significantly correlated. Students who began with greater perceptions of ideas, also tended to have higher levels of confidence ($r = .72$). This relationship was even stronger at the time of the posttest ($r = .84$). The coefficient of determination (r-squared = .71) suggests that 71% of the variance in students' confidence ratings could be "explained" by students' perceptions of their ideas for technology integration. In other words, the more ideas students have about technology integration, the stronger their belief that they can be successful integrating technology into the classroom. As ideas increase, so, too, does confidence for implementing the ideas.

Interestingly, judgments of computer competency (skills) were not highly correlated with either ideas or confidence for technology integration. This supports earlier research findings (Moursund & Bielefeldt, 1999; Yildirim, 2000) that suggest that simple skill training is insufficient to prepare students to use technology in the classroom. Although judgments of computer skills were moderately correlated with students' ideas for using technology prior to VQ ($r = .34$; $p < .001$), this relationship was not significant after using VQ ($r = .28$; $p > .001$). Furthermore, skill competency did not seem to translate into confidence for achieving integration either pre or post VQ ($r = .18$ and $.26$ respectively). Just because students know how to use word-processing, email, and the Internet, does not mean that they know how to use these skills within classroom instruction or that they are confident trying to do so.

Perceptions of Using Electronic Models

Interviews with 10 students, as well as data obtained through four post-survey items and two software evaluation questions, were used to answer our research question regarding students' perceptions of using electronic models to learn about technology integration. Interviewees were representative of the students enrolled in the class; interviewees included both male and female students who ranged in age from 18-34 years, in skill levels from beginner to advanced, and in confidence levels from "somewhat" to "very" confident.

Two questions on the software evaluation form asked students to rate the relevance of the activities and models observed on VQ. On a scale from 1 (strongly disagree) to 5 (strongly agree), students agreed to strongly agreed that "activities regarding the use of technology were realistic" (mean = 4.46) and that "the video cases of teacher interviews and class activities were relevant" (mean = 4.31). Four similar questions included on the post survey averaged a 3.96 rating indicating that students' perceived the VQ models to be both realistic and relevant.

Although students had suggestions for improving the software (particularly in terms of navigation, which was unfinished at the time), interview comments were overwhelmingly positive. Students viewed the models as realistic, indicating that they felt as though they were in the classrooms with the teachers. Students described the "life-like" quality of the videos and how they felt that the teachers were talking directly to them (S: I felt like they were talking to me as a teacher and not as a student). As an example, one student stated:

> I liked it. I liked how I got involved when it showed you (the clips) and you felt like you were right there in the classroom with the students watching them. It's like you're in a movie theater almost because they have such good (videos)... and it shows the students and it shows the teachers – and you feel like you're right there in it.

Because our survey instruments did not provide information about the specific ideas that students may have gained using VQ, we asked students to describe these ideas in our interviews. Students indicated that, by observing the classroom examples on VisionQuest, they had gained ideas about "using stations," "assessment," "group work," "using different activities to teach the same content," "integrating computer research into a music classroom," "using technology to work with different levels of students-special ed and those who excel," "using HyperStudio in a music class," and "establishing a good climate in the class." Students made many comments about how VQ allowed them to see how things were done in a classroom. Three representative comments follow:

> I think actually seeing the teachers in the video clips and how the students are actually using it and how the teachers are using it and incorporating it in their lessons-I think was really good for me. I had ideas going into VisionQuest of how I could use technology in my classroom but actually seeing teachers using it gave me some new ideas of 'Oh, I didn't think of using it like that.

> Seeing the teachers use technology helped me to understand how it's done...it's one thing to hear someone talk about different methods, but seeing the classes actually use the technology--that really made me think of how I could do it next year.

> I liked the examples and the students' points of view. They had a lot of good ideas about what they were doing. It's a good way to teach us about what you can do with computers. And we used a computer. This was a good way for us to see what goes on in a classroom. I could see doing things like they did.

Students agreed that it was beneficial to *hear* the teachers in addition to seeing them. Exploring teachers' beliefs helped students understand why teachers made the decisions that they did, and provided cognitive modeling of the integration task. For example, one student noted:

> I think it's really neat how you have the different clips in there, the different classrooms and you have the students' opinions and the teachers' opinions. It's got their different beliefs and teachers can take that and maybe it will change their philosophy and they can interpret new things into their classroom. I think it's a very good program and it's got a lot of potential.
>
> I liked it. I thought it was pretty cool the way you could see what they were doing in all those schools. The interviews were really good because you get a chance to see what they think about their own classrooms and they talk about what they want to do. You could click on the materials or the interviews.

Based on these results it appears as though students both enjoyed and benefited from observing the electronic models provided on VisionQuest. Interview comments suggest that preservice teachers perceived that the use of electronic models was a positive approach that provided "life-like" learning experiences. There were no comments to suggest that the students found it difficult to identify with the models presented via CD-ROM technology.

Discussion

This study examined preservice teachers' perceived ideas about and self-efficacy for technology integration before and after observing electronic models of exemplary technology-using teachers. Sixty-nine students, enrolled in a one-credit technology course, completed online demographic and survey instruments and then used a CD-ROM electronic modeling tool during the tenth and eleventh weeks of the semester. To measure changes in students' perceived ideas and self-efficacy, the online surveys were completed again at the end of the second session.

The results of this study support our hypotheses that electronic models can be used to increase preservice teachers' ideas about and self-efficacy for technology integration. Even though students used VisionQuest for a relatively short period of time over the course of two class sessions (approximately 90 minutes total) and were unable to explore the entire content of the CD-ROM, students showed significant increases in both their perceived ideas about and self-efficacy for technology integration. Interview and software evaluation comments indicated that students found the models to be both realistic and relevant. Students described a number of specific ideas that they gained from the models and furthermore, described their intent to apply these ideas within their future classrooms.

The 69 students who participated in this study were not novice computer users; in fact, the majority of our participants (n = 63) rated themselves as either intermediate or advanced computer users. In addition, initial ratings of perceived ideas about and self-efficacy for technology integration were not exceptionally low (x = 3.72 and 3.84, respectively). Still, ratings of perceived ideas and self-efficacy increased significantly from pre- to post- VisionQuest suggesting that students were able to gain additional ideas and confidence by observing the models on the CD-ROM.

Students' pre- and post- ratings of their ideas and confidence were not significantly correlated with their judgments of skill levels, suggesting that computer skill competency does not translate directly into ideas or confidence for classroom technology use. In fact, students' perceptions of the direct usefulness of their skills may have decreased after seeing how the teachers on VisionQuest were not dependent on high skill levels, although this conjecture requires further examination. However, there were significant correlations between students' perceived ideas and confidence, especially at the time of the posttest (r = .84) suggesting that as students see new ways to use technology and develop new ideas about technology integration, they develop higher levels of confidence about their ability to use technology in a variety of ways.

Based on the correlations obtained, providing preservice teachers with specific integration ideas (e.g., how to organize a classroom that uses technology, how to assess student technology products) via electronic observations of technology-using teachers may be more effective than skills training for increasing their self-efficacy for technology integration. Furthermore, by increasing future teachers' self-efficacy, we increase the probability that these behaviors will be implemented in their future classrooms. According to Olivier and Shapiro (1993), "Self-efficacy has been shown to be an excellent predictor of behavior. Individuals with a low sense of self-efficacy will, more often than not, shy away from the best alternative, and, instead, choose an alternative that they believe they can handle" (p. 84). Even when practicum and student teachers possess "positive dispositions towards computer use," they often lack confidence in their ability to teach successfully with computers (Albion, 1999). This lack of confidence for teaching with computers has been shown to influence the levels of computer use by student and beginning teachers (Albion, 1996; Handler, 1993).

The lack of significant correlations among age, class, gender, and skills and pre- and post-measurements of ideas and self-efficacy (see Table 1) suggests that all of the students in this study were able to gain ideas and confidence through their interactions with the electronic models. That is, no one group of student was more or less likely to have more ideas or confidence for technology integration. Previous research has suggested that using a variety of models increases the possibility that students will find at least one model they can identify with (Schunk, 2000) and also provides additional information about a number of effective strategies that can be used to achieve integration.

Educational Implications

The results of this study suggest that preservice teachers can benefit from observing teacher models presented via multimedia case examples, such as those featured on VisionQuest. Whether delivered via the Web or CD-ROM, multimedia models are becoming more readily available for use by teacher educators. These types of examples can be incorporated into an educational environment for self-paced exploration, as a small group reflection tool, or as an instructor-led activity. From an instructor's perspective, electronic models can positively impact the authentic nature of a course and simultaneously increase the confidence and integration beliefs of students. This type of modeling can help preservice teachers develop a vision for what technology integration looks like in real classroom as well as strategies for implementing those visions.

Limitations and Suggestions for Future Study

The primary limitation of this study relates to our inability to isolate specific cause and effect variables. Because VQ was part of the course curriculum for the students who participated, and was scheduled to be used at a specific time in the semester, we were unable to create a control group for this study. However, future efforts will include use of a cross-over design, that is, one that would introduce VQ to a control group at a later time in the semester. This would allow for a more systematic look at the effect of VQ on students' perceived ideas and efficacy.

Participants in this study were fairly homogeneous; generalization to groups differing in age, gender, ethnicity, or levels of computer competency may not be appropriate. As an example, it is unclear whether the use of exemplary models will be equally effective with novice users who are likely to begin their explorations of the CD-ROM with much lower levels of ideas and self-efficacy. There is some evidence to suggest (Snoeyink, 2000) that teachers need at least a very basic skill and confidence level before they can benefit from observing exemplary others. Because our study did not include participants who rated themselves as novice users, we were unable to answer this question.

An additional limitation of this study relates to our inability to determine if students' perceptions of having many ideas for technology integration actually translate into classroom application, as hoped. Although student worksheets and interview comments suggest that students gained new ideas, additional work is needed to determine the extent to which these students are able to carry out these ideas when they actually assume leadership of their own classrooms. Still, according to social learning theory (Bandura, 1997), building self-efficacy is an important first step toward developing the capacity to perform a particular skill. Without a sufficient level of self-efficacy for performing computer tasks, technology integration may not even be attempted (Olivier & Shapiro, 1993). Models can serve informational and motivational functions for observers (Schunk, 2000), yet further research is needed to verify the long-range benefits of increasing self-efficacy through the use of electronic models.

Conclusion

Teachers today face a number of challenges as they begin integrating technology into their classrooms, not the least of which include a lack of specific ideas about how to organize and manage integrated classrooms, uncertainty about how to implement new roles within current classroom routines, as well as a lack of confidence for implementing these new types of ideas and roles. Even as our teachers are gaining more computer skills, they continue to report feeling unprepared to use technology in the classroom (NCES, 2000). As educators begin to realize that skill training is not enough to prepare teachers to integrate technology within the curriculum, their attention must turn to helping both pre- and inservice teachers gain specific ideas and confidence for technology integration. How then, can this be accomplished in the most effective and efficient way?

Although self-efficacy theory suggests that personal successful experience with technology in the classroom is the most powerful means for building teachers' self-efficacy (Bandura, 1997), this is almost impossible to achieve in practice. Simply trying to arrange field observations of exemplary technology-using teachers is fraught with difficulty. Even if we were able to find sufficient numbers of exemplary technology-using teachers who were willing to allow visitors in their classrooms, handling the logistics related to scheduling classes, transporting students, and arranging appropriate times to visit would be a nightmare. The use of multimedia materials that incorporate examples of effective classroom use of technology helps eliminate these logistical concerns. Data from this study suggest that providing preservice teachers with opportunities to interact with exemplary technology users, through electronic models, is a viable means for increasing capacity (ideas and self-efficacy) for technology integration.

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Women's Contributions to the Leading Journals in Instructional Technology, 1995-2000

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Introduction

This study examines the articles from current journal literature in the field of instructional/educational technology to ascertain the number of articles written by women each year and the content that women are addressing in their articles. A previous study of the journal literature (Foley, Gurney, & Branch, 1994) examined women's contributions to the literature from 1988-1992. Both the current and previous analyses used methods similar to Ely's work in analyzing the literature of the field (Ely, 1996). This study uses an analysis of the topics of articles to develop themes found in the literature and compares these to the trends and issues identified by Ely (1996) and Molenda, Russell, & Smaldino (1998). Finally this study takes a critical look at these articles from a feminist perspective in regard to gender issues.

Rationale

Instructional Technology Research Agenda

A rationale for investigation of women's contributions to the literature in educational/instructional technology comes from several sources. Molenda (1996) describes an agenda for research in the field in order to "determine where the knowledge gaps are…" (p. 38) and calls for an examination of the "adequacy of journals and periodicals" (p. 40) as a means of describing communication within the profession. In addition, Molenda (1996) calls for an examination of external forces that influence the field. Specifically he asks, "What societal forces are affecting the profession? What are the forces that assist or impede the appropriate adoption of technology in education?" (p. 41).

Our personal experiences in higher education and in the field have yielded real concerns about the field of educational technology and specifically instructional design in terms of how/if they incorporate women's perspectives. Most articles, books, and literature in the field that instructional design students are exposed to continue to be written by men from a clearly masculinist perspective. That the field has the potential to change can be evidenced by the introduction of these texts by women (Driscoll, 1994; Driscoll, 1998; Seels & Richey, 1994; & Glasgow, 1990; Smith & Ragan, 1999) used in the foundational courses in the instructional design program at a leading university (personal correspondence, 2001).

A Focus on Women's Contributions

There are valid reasons why a study of the field should include a focus specifically on women's contributions. As is documented in recent statistics, teaching is (still) a female dominated profession. Findings from the 1993-94 survey by the National Center for Education Statistics show that 73% of teachers in public K-12 education and 75% of teachers in private K-12 education are women (National Center for Education Statistics, 2001). Ely also states, "There is an insistence that teachers must become technologically literate" (1996). As noted in both Ely's (1996) and Molenda's (1998) trends, computers are pervasive in education settings and educational technology is seen as a "major vehicle for educational reform" (Ely, 1996). Women, then are potentially prime purveyors of the educational/instructional technology literature as it relates to K-12 education.

Reflections on Previous Studies

The foundational study of women's contributions to the literature (Foley et al., 1994) came out of graduate experience that involved instructional design classes populated predominantly by women students without reference to one female author. At that time it was found that the percentage of articles by women in 11 instructional technology journals ranged from 68% to 20%, with "no discernable patterns [found] within each journal over the five-year period [1988-1992]" (p. 59). An analysis of the content of articles written by women revealed that most articles concerned computers (11%) and computer assisted instruction (5%) and the non-specific category of design and development (8%). Only 2% of all the articles written by women in the same period addressed gender issues. The fact that so few women in the field were not writing about gender raised the question concerning "the experiences of women attempting to publish in the field of instructional technology" (p. 59).

Ely has completed a series of analyses of the publications of the field. Most recently he identified eight trends (1996). Molenda et al. (1998) identified ten key issues from their analysis of the literature of the field. A comparison of Ely's and Molenda's findings, shown in Table 1 below, identifies many similarities and some differences.

Table 1 Comparison of Ely's Trends and Molenda's Issues in Instructional Technology

Ely (1996)		Molenda et al. (1998)
Computers are pervasive in schools and higher education institutions. Virtually every student in a formal education setting has access to a computer.	↔	Incorporation of computer-based media into the instructional mainstream.
Networking is one of the fastest growing applications of technology in education.	↔	Incorporation of telecommunications-based media into the instructional mainstream.
Access to television resources in the school is almost universal.	↔	Incorporation of traditional audiovisual media into the instructional mainstream.
Advocacy for the use of educational technology has increased among policy groups.	↔	Acceptance and support of the concept of Educational Technology.
Educational technology is increasingly available in homes and community settings.	↔	The home as locus of technology -based learning.
New delivery systems for educational technology applications have grown in geometric proportions.	↔	Application of advanced interactive technologies (multi-media, hypermedia, virtual reality.
Educational technology is perceived as a major vehicle in the movement toward education reform.	↔	Restructuring/Reengineering of basic organizational processes.
Unique Trends and Issues Ely (1996)		Molenda et al. (1998)
There is a new insistence that teachers must become technologically literate.		Updating paradigms and procedures for instructional systems design. Growing interest in learner-centered, inquiry-based instruction. Commitment to increasingly authentic assessment.

Methodology

Research Questions

Two questions guided this study:

1. What percentage of articles are written by women each year in leading educational technology journals?
2. What topics are women writing about in leading educational technology journals?

Journal Selection

Selection of seven journals for inclusion in this analysis were based on Ely's (1999) identification of those publications read by educational technologists. The seven journals included in this analysis are; *British Journal of Educational Technology, Educational Technology, Educational Technology Research and Development, Innovations in Education and Training International, Journal of Research on Computing in Education, Learning and Leading with Technology* (formerly published as *Computing Teacher),* and *TechTrends*. Six of these seven journals are cited as leading educational technology journals for publishing in the field (Price & Maushak, 2000); *Innovations in Education and Training* is not included in the latter list. Analysis was conducted in these journals over a six-year period, 1995-2000.

Quantitative Analysis

The process for descriptive quantitative analysis involved: 1). documenting the number of articles written in each journal; 2). ascertaining which articles were written by women as either first or second author; and 3). determining the percentage of articles that were written by women annually for each journal. Editorials and regularly published columns were not included in this analysis. Selection of inclusion for an article was based on first or second authorship by a woman. While many articles were written by larger groups of people and women's names appeared as authors in the group, ERIC protocol limits two authors in their citations and experience has shown that lead authorship is most often ascertained by order. Because this is a study of the contributions of women in the field we wanted the articles included in this study to reflect a clear leadership role of the women authors, both in terms of content and context of the article.

Determination of gender was based on analysis of the first names of one of the first two authors. Some journals (conveniently) provided pictures of the primary authors or brief biographies that often included a feminine or masculine pronoun. Difficulties arose when authors were identified by first initials only and for those European names that are typically used by either women or men (Robin, Leslie, Lyn, etc). In addition, because neither of the coders were familiar with Asian, Arabic, Indian, and some European names, a list of unfamiliar names was distributed to colleagues from these geographic areas for further identification. For those cases, where gender could not be determined for first or second author, the article was eliminated from analysis in this study.

Content Analysis

This study employed a content analysis methodology based on Ely's (1996) and Foley's et al. (1994) previous studies. The process of content analysis involved: 1). identifying the total number of articles each year, excluding regularly published columns and editorials; 2). ascertaining the number of articles written by women as either first or second author; 3). describing the content of the article by two coders; and 4). negotiating final category placement through a dialogic process. Both coders, authors of this article, are experienced instructional designers. Coders examined each article authored by women and identified a category that best described the focus of the article. Whenever possible coders used the author's words to assign a content category. In cases where different words described the same thing, (i.e. computer assisted instruction/ computer based instruction) one category was created for both (computer assisted instruction). After independent coding, coders negotiated differences in selection of category, making a case for one or the other or collaboratively choosing an alternate category that satisfied both coders.

One difficulty in determining category arose when addressing process/product over context. Articles describing the use of technology or computers in special education were placed in the category of Education K-12. Finally, because the purpose of this study was to determine if women are writing about women's issues in the field, gender was a primary category regardless of context. Because negotiation was an essential part of the process, analysis had to be conducted in a timely fashion. Articles had to be independently coded and discussed within a short working period so that coders could remain familiar with the content of each article during negotiations.

Findings

What percentage of articles are written by women each year in leading educational technology journals?

A total of 1809 articles were published from 1995-2000 in the seven journals included in this study. Of these, 993 articles were written by women as first or second author. The percentages found in Table 2 below reflect annual averages for each of the journals included in the study. The percentages of articles written by women range from a low of 33% to a high of 74%. An analysis of the percentages shows no discernable trends, increases/decreases from year to year. Three journals (*Educational Technology Research and Development, Journal of Research on Computing in Education, and Learning and Leading with Technology*) consistently had an annual average of 50% or more articles written by women; one journal (*Educational Technology*) had an average of less than50% of articles written by women over the 6-year period. It should be noted that two of these journals are published internationally, although no differences were reflected in their annual percentages from those published in the US. All of the journals except one had a research focus; *Learning and Leading with Technology*, the exception, is a K-12 education practitioner oriented journal. Given the predominance of female teachers in public and private schools (NCES, 2001), no doubt affects the predominance of women authors in this journal. This journal was unique in another feature – it published over 600 articles in the 6-year period of this study, nearly one-third of the total number of articles. Of these 295 were in the category of curriculum development. It was felt that this inordinate number of articles in one category from one journal would skew the findings and so this number was not used in the analysis of content, but was included in the quantitative calculations of percentages of articles written by women. Clearly there is a difference between research and practitioner based journals both in terms of quantity of articles published and in the gender of the primary authors as shown in the figures below.

Table 2 Percentage of Articles Written by Women, 1995-2000

Journal Title	1995	1996	1997	1998	1999	2000	Means
Learning and Leading with Technology	54%	50%	69%	74%	74%	66%	64%
Journal of Research on Computing in Education	62%	50%	73%	63%	64%	50%	60%
TechTrends	42%	55%	55%	41%	71%	59%	54%
Educational Technology Research and Development	52%	53%	56%	50%	55%	50%	53%
Innovations in Education and Training International	54%	45%	45%	49%	63%	63%	53%
British Journal of Educational Technology	50%	47%	39%	58%	48%	69%	52%
Educational Technology	39%	37%	46%	33%	34%	40%	38%

What topics are women writing about in leading educational technology journals?

An examination of the content analysis was done on two levels. Categories were sequenced by the number of articles found in each category. From the perspective of individual categories there were nine content categories most frequently cited in Table 3 below.

Table 3 Most Frequent Topics of Articles Written by Women

Content Category	Frequency
Distance Education	49
World Wide Web – Internet	40
Instructional Strategies	35
Multimedia	35
Integration of Technology in Education	32
Effects of Technology (in any context)	30
Teacher Education	29
Computer Software	27
Professional Development	26

Further analysis clustered individual categories together into the themes found in Table 4. As can be seen by this table, a quarter of the articles written by women in this study addressed technology, with a focus on uses of the World Wide Web and the Internet. Nearly a quarter of the articles addressed instructional delivery systems, with the greatest focus in this theme describing the delivery of distance education. Education/training was also a frequently cited theme and included pre-service teacher education and in-service professional development in both education and business contexts. The theme of design, development, and evaluation spanned the gamut of tasks these processes describe with no concentration in any one area. Interestingly, society, the theme that included gender, multicultural, and minority issues, was not addressed in many of the articles written by women in these journals.

Table 4 Themes and Percentages of Total Articles Written by Women

Themes	Percentages
Technology – Internet, Media, and Computer Software	25%
Instructional Delivery Systems	24%
Education and Training	15%
Design, Development, and Evaluation	10%
Society	8%
Learners and Learning	5%
Utilization Processes	4%
Research and Theory	3.7%
The Field	3%
Management	1.4%

Comparison of Findings

The themes described for this study can be compared with those of Ely (1996) and Molenda et al. (1998) found in Table 1 previously cited in this article. In concurrence with these recent studies, this study found that computers and technology are clearly the most frequently addressed topics by women writing in the field. Technology is addressed on several levels: development (software, multimedia), implementation (distance education and instructional strategies), and preparation (teacher education, continuing education, and professional development). This makes intuitive sense, as technology addresses the main focus of research in the field. More specifically, women also wrote about computer networking and applications of technology, the World Wide Web and the Internet, telecommunications, multimedia, and hypermedia. In addition, much of the content of the literature in this study focused on the uses of technology to deliver instruction, specifically in the development of distance education as a means to effectively reach a wider audience of learners.

As Ely (1996) found in his study, women are writing about the need for more training and education in the use of technology, as evidenced by the numbers of articles on professional development, teacher education, and continuing education. Many of the articles in this study addressed the integration of technology in classrooms and curriculum, specifically computer assisted/computer based instruction and web-based instruction and the use of expert systems. Similar to Molenda's et al. findings (1998), the women in this study addressed how best to instruct students, with a focus on authentic, learner-centered activities, instructional strategies that support active and interactive learning and problem solving. Women in this study addressed the integration of technology in education and the effects of technology as a way of moving education reform and meeting current needs for meeting teaching and learning standards.

Contrary to Molenda's findings (1998), articles in this study rarely addressed policy or advocacy in the use of technology nor did they write about management issues. An examination of the roles of women in the field might explain this lack of focus. How many women are in management and administrative positions where policy is addressed? The women in this study rarely cited instructional systems design (ISD), or research paradigms, methodology, or theory. Are women's articles more practitioner focused than others? How does this lack of articles reflect the discriminatory notion that women are not suited to abstract thinking? This study revealed no articles addressing the role of computers or technology in homes or communities. Is this a counter reaction to women's traditional place in the home and community and outside of the professional technological arena? Unlike Molenda's findings, there was no strong focus on authentic assessment, although there were articles that addressed assessment in general.

There were several surprising omissions found in the content analysis of these articles. Unlike Ely's and Molenda's previous studies the articles analyzed here did not address the more traditional audio/visual media. The articles included in this study tended to describe technology with an uncritical gaze, without reflection on theoretical frameworks or critiques. Finally, given the statements of concern voiced by many feminists as to the gender inequity in the field, this was not a concern that was addressed by many of the authors in this study (11 articles, 1.5%). Comparing this figure to previous findings of 2% (Foley et al., 1994), there is no real change and in fact a slight decrease in the percentage of articles regarding gender issues. Yet others (Bryson & de Castell,1995; Damarin,1994; Henderson,1996; Knupfer,1997) are writing about gender bias and the design and applications of technology, indicating the issues are not resolved in the field. The omission of gender issues in the literature points to a gap of knowledge that needs to be addressed more frequently. While in general gender issues are seen to be part of women's domain of concerns, women in the educational/instructional technology show slight interest in developing our awareness of these issues in the field.

Conclusion

Nearly all of the journals cited in this study had annual percentages of 50% or more articles written by women. This marks great improvement over past studies and recognizes women's contributions to the field. However, it should be noted that despite these aggregated annual statistics there were individual issues of journals that contained no contributions by women. There were some similarities between the topics of articles described by Ely and Molenda et al., however there were some striking differences. A curious ancillary finding of this study is that only 1.5% of articles written by women addressed gender issues and technology. This finding correlates to the previous study by Foley et al. (1994) where 2% of the articles written by women addressed gender. Questions arise as to why this is not a more pervasive theme of women's contributions to the literature.

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AECT Needs Survey, 2000

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Abstract

The purpose of this study was to determine the needs of AECT members. A total of 590 individuals completed a web-based survey after receiving an e-mail invitation from AECT. This survey was active between October 30 and November 10, 2000. The survey was categorized into three parts: demographics; publications; and conference. Resulting data was categorized, coded, and compiled. The study yielded five major findings. First, more than half of the respondents are affiliated with higher education. Second, the AECT conference is important to members with or without a trade show. Third, restructuring efforts are incomplete. Fourth, respondents noted communications problems in the organization. Fifth, online services need to be improved. Improved communication within the organization is imperative.

Purpose of the Study

In order to determine needs of AECT members and to identify the association's strengths and weaknesses, we conducted a survey. We have shared the results of this study with AECT leadership and now summarize the findings for AECT members in order to provide feedback on recent changes in the association, and to help guide decisions about AECT's future.

Research Questions

Seven research questions were investigated in this study:

1. What services does AECT provide well?
2. What are the needs of AECT members?
3. How satisfied are the members with the quality of AECT publications (*TechTrends & ETR&D*)?
4. How satisfied are the members with the AECT online conference registration service?
5. What conference networking opportunities are helpful to members?
6. How important is the trade show at the conference to members?
7. How satisfied are the members with the decision of restructuring and renaming divisions?

Method

Instrument

We interviewed the current Executive Director of AECT in October, 2000. He shared a list of questions that, after discussion and clarification, were incorporated into the list of questions included in this needs analysis survey. We also used two questions from the 1999 member needs survey to see how members would respond to the same questions. Then we designed the sixteen-question survey which included three demographic questions, five five-point Likert-type scale questions, four multiple choice questions and four open-ended questions.

Participants

AECT maintains a database comprised of members and individuals who subscribe to the periodicals published by AECT. E-mail was sent to 3084 names in the database, of whom 1846 of were members as of November, 2000. The e-mail message invited individuals to complete an online Web survey.

Data Analysis

We ended the survey on November 11, 2000, and prepared both quantitative and qualitative data files for analysis. After examining the data, our team discarded 15 responses from the total number to eliminate multiple responses by individuals; and this yielded 590 member and nonmember unique responses to the survey. We analyzed the quantitative data that were generated by multiple choice and five-point Likert-type scale questions by SPSS. Then we conducted a content analysis with the qualitative data generated by open-ended questions.

The following paragraphs describe how we defined categories for open-ended questions.

Question 4. What does AECT do for you now that you find most beneficial?

In response to the question of what respondents felt was the most beneficial aspect of AECT, respondents' comments indicated 8 categories of responses.

Responses that mentioned written journals, *ETR&D*, or *TechTrends* were placed in the category of "Publications". Typical comments from this category include the following:

- *AECT keeps me informed of the most recent findings, studies and research.*
- *These present broader views and information that I would have trouble finding elsewhere.*
- *TechTrends*

Responses that mentioned any aspect of the national conference were placed in the category of "Conference". Typical comments from this category include the following

- *The annual conference is the most beneficial part of AECT. As a media/info-tech administrator I always am able to get GREAT information that I can apply when I return home.*
- *The national conferences were always of value in helping one understand new theories, techniques, and ways in which to use media in the teaching and learning process.*
- *Annual Conference*

Responses that mentioned any aspect of social or professional interaction, whether as part of a conference, presentations, or informal gatherings outside of the conference were placed in a category named "Networking". Typical comments from this category include the following:

- *Networking with colleagues and diversity of programming when it is good.*
- *Provides a venue for the exchange of knowledge and/or research in our field. Also provides opportunities to network and interact with colleagues.*
- *Provides contacts with colleagues, old and new, which leads to opportunities to visit and work at institutions outside the U.S.*

Responses that mentioned any aspect of professional improvement, current issues, trends, or keeping up with developments were placed in the category entitled "Professional Development." Typical comments from this category include the following:

- *Keep up with latest development in educational technology.*
- *AECT helps to keep me updated as to what is current in the field.*
- *Keeps my coworkers up to date on current issues and trends.*

Responses that mentioned any aspect of electronic communication through the Internet or the World Wide Web, email or listserv communications were placed in the category entitled "Web Services". Typical comments from this category include the following:

- *The job postings site is most useful.*
- *The Website is useful. I get most of the information from the AECT Web.*
- *listserv newsletter.*

Responses that included the concept of employment-related issues were placed in the category of "Employment Information." Typical comments from this category include the following:

- *It provides employment leads.*
- *Job listing (when current).*

Responses stating that the respondent does not like some general aspect of AECT were placed in the category entitled "Negative". Typical comments from this category include the following:

- *At this time nothing. Several years ago the journal and conference provided good opportunities for learning.*
- *I do not currently benefit from AECT.*
- *I have found nothing of value the last two or three years...the organization has been in transition and cannot function until the transition is complete.*

Responses that did not fit into any of the categories that had been established for this question were placed in one category that was entitled "Others". Each of the responses could possibly make its own category and stand alone in this report, but our research team felt that they should be joined in the "Other" category. Typical comments from this category include the following:

- *The membership is diverse, freeing me from the parochial view of one section of the profession; participation in the organization and its governance is encouraged (most national organizations discourage it with red tape); the people are wonderful, supportive and generous with their expertise; the summer leadership institute is excellent.*
- *Phil Harris, with his staff, and the AECT President and Board of Directors are actively looking for ways to support and encourage the AECT International Student Media Festival. Charles White shares the vision of ISMF that it serves as a natural introduction to AECT for teachers and students interested in the role of media in education.*
- *TechTrends, copyright issues, new products, how a new technology works in real situations. Ed issues and On-line classes. New topics on Internet usage. Teacher training.*

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Question 5: Please list the most important thing AECT should be doing for you now that it does not currently do.

In response to question five in which respondents were asked what it was they felt was the most important thing that AECT should be doing that they were not currently doing. Member comments separated into 7 categories of responses. Responses that indicated some kind of need that was associated with the AECT National Conference were placed into the category entitled "Conference". Typical comments from this category include the following:

- *Thought that the lack of exhibits at national conferences was big weakness, but that will be satisfied in Denver, I assume. Organization is now doing, or about to do, most of the things that I think a national professional organization should do.*
- *I would like to participate in a conference but time, location, and funding are an issue. I would like to see AECT sponsor an online conference or include online conference participation at its f2f conferences.*
- *Providing a scholarly conference that is respected and has credibility. Provide timely information on topics relevant to our field.*

Responses that included a mention of communications, response or lack of response to submitted questions, or a flow of information were put into the category entitled "Communications". Typical comments from this category include the following:

- *Communicate with members better. I sent in my membership months ago, and I've started receiving pubs, but I don't remember receiving any acknowledgment of my membership. I was wondering about it until I started receiving TechTrends.*
- *Create a clear link of communication between the members and administration so members can become more involved in policy and know what to expect from one conference to the next.*
- *Provide data/opportunities/support for better communication throughout the year.*

Responses that mentioned publications, articles, *ETR&D, TechTrends,* or journals were placed in the category entitled "Publications". Typical comments from this category include the following:

- *AECT should be continuing to publish a scholarly journal. I have not yet received an issue of ETR&D.*
- *More publications.*
- *AECT journals need to improve their quality of articles. Emphasize research-based reviews of educational technology uses in the classroom to help K-12 teachers in implementing technology in the classroom.*

Responses that referenced electronic material including websites, listservs, electronic communications, or email were placed in a category entitled "Web Services." Typical comments from this category include the following:

- *Message board or listserv for ongoing member interaction/discussion.*
- *Provide me with the electronic capability to reach out to my state people and to other colleagues individually and updating me electronically on the state of the organization. Our name says communication and technology or, communication through technology.*
- *Access to electronic materials e.g. back issues of journals etc.*

Responses that included a discussion of the restructuring efforts, organizational efforts, or changes within the AECT were placed in a category entitled "Organizational Restructure." Typical comments from this category include the following:

- *Restructure organization so it can best serve its members (e.g. conference coordination, quality control of its publications, etc.).*
- *Be more organized and professional.*
- *Provide a viable organization that combines 'clout' with an outlet for academic research.*

Responses that indicated a need for development of professional skills or services or for keeping up with trends were placed in a category entitled "Professional Development." Typical comments from this category include the following:

- *Providing a sense that this organization is keeping up with the latest trends in instructional design throughout the year.*
- *More professional development activities on the regional level.*
- *Professional Development. I know many people are involved in the leadership and other efforts within AECT, but I don't know how to get into that 'inner circle.' I've always felt like an outsider, except for participation in the annual conference.*

Responses that noted single instances of a suggestion were sorted into the category entitled "Other". There was no discernible trend noted in this category, and so they were combined into a single category of suggestions. Typical comments from this category include the following:

- *Role of Media Specialists in the changing school environment.*
- *Continue to seek member involvement in ways like this.*
- *Uncertain what it could do for me since I'm a bit away from the center of things and haven't been able to attend a conference for several years. Mainly – just keep information coming.*
- *I am not aware of services that would be beneficial for me that I am not getting from somewhere else that AECT should provide.*

Question 15. How did you first become aware of AECT?

In response to the question of how respondents first became aware of the AECT, comments were sorted into 6 categories of responses. Responses that indicated the individual had first learned about the organization while attending a graduate program or that they had learned about the organization in graduate school were included under the category entitled "In Graduate School." Typical comments from this category include the following:

- *From faculty members during graduate school.*
- *As a graduate student some 35 years ago....*
- *Through discussion with faculty in graduate school.*

Responses indicating that initial awareness of the AECT organization had come from contacts with professional colleagues and peers were grouped under the category "From Colleagues and Peers." Typical comments from this category include the following:

- *Fellow professionals.*
- *Recommended by my colleagues.*
- *My father has been a member for many years, and then when I entered the field, my boss was a member.*

Responses from individuals who named a variety of different sources that did not fit easily under existing categories were grouped under the category entitled "From Various Sources." Typical comments from this category include the following:

- *As a beginning professional by attending a regional conference...*
- *Link from another web site*
- *In 1980 we hosted the then active Missouri Affiliate in Cape Girardeau MO. I have been a member ever since.*

Responses from members who had been a part of the organization for such a long period of time that they couldn't remember the original exposure to the organization were included under the category entitled "Cannot Remember." Typical comments from this category include the following:

- *Don't remember...*
- *Don't recall...*
- *...I don't remember how I became aware of it.*

Responses from individuals who first learned of the AECT by means of written publications or journals are organized under the category entitled "From Publications."

- *learn from TechTrends and join by mail.*
- *In search of publication outlet.*
- *Via periodics (sic) at University's library.*

Responses from individuals who had first learned of the existence of the AECT while attending an AECT conference are included under the category entitled "At the AECT Conference." Typical comments from this category include the following:

- *Convention in Miami in 1979.*
- *Through exhibits at the WEMA conference in Wisconsin.*
- *Really got involved after attending an AECT Region 6 leadership conference in 1981...*

Question 16. Please list any other comments that would benefit the AECT leadership in determining future directions.

In response to the invitation asking respondents to list any general comments that would benefit the AECT leadership in determining future directions, respondents' comments were sorted into 11 general areas. Responses that indicated the AECT needs to focus efforts in the restructuring process were reported under the category entitled "We need to define AECT's focus." Typical comments from this category include the following:

- *AECT must clearly define its purpose. Direct activities to that purpose. Make its membership services supportive of that purpose.*
- *AECT needs to decide who its members are and provide opportunities for those members to meet...*
- *Find your niche, and stick to the knitting. Don't try to be all things to all people, which the old AECT never learned. Based on what I see in the new division structure, I'm not sure AECT has learned it yet.*

Responses that spoke of perceived communication difficulties between the administration of AECT and the membership were grouped under the category entitled "AECT needs to improve communications with the membership." Typical comments from this category include the following:

- *Please have someone available at the telephones at the office. I have tried to reach a person on several occasions and only left messages which were not returned.*
- *To strengthen AECT membership, I believe AECT should acknowledge its members by sending a membership card...*
- *There appears to be no way to become involved in the governance and workings of AECT without 'knowing someone.' Please promote opportunities for people to become involved in the divisions and councils or in planning the conference.*

Responses that indicated problems or solutions to difficulties encountered during attendance at the national conference are grouped under the heading "Conference needs improvement." Typical comments from this category include the following:

- *...improve the organization of the conference. I overheard several people commenting on how unorganized it seemed to be....*
- *The program needs to be better organized. Denver was a mess with sessions listed in one place, changed in the addendum in another, and shown on the TV monitors in a third....*
- *...I go to this conference because of its diversity – which was down a good bit this time. Frankly, it has overpriced itself at this point. I would not have attended this conference at this price if I were not involved in governance areas.*

Responses that indicate problems or issues that have been apparent within the AECT website are included under the category entitled "Website needs improvement." Typical comments from this category include the following:

- *...keep the WWW site up-to-date (online job listings are great...member directory on-line would be nice).*
- *Please, please upgrade the website...*
- *The AECT website needs some dramatic fixing by people who know good graphic and user-interface design and good content editors....*

Responses of a broad nature that addressed very specific circumstances and yet were unable to be grouped with other responses formed a category entitled "Miscellaneous." Typical comments from this category include the following:

- *I joined AECT as a graduate student and attended conventions. At the 225 dollar price of Denver, I as a graduate student would never have been in AECT or participated for so many years.*
- *Get great speakers instead of so many social functions. Cut the exhibits if we can't get enough vendors to make it worthwhile. Confirm all presenters in advance. Cut the costs if possible.*
- *We MUST have a better process for letting people know if their papers were accepted. We did not find out until we got the program in Denver that one of ours was accepted.*

Responses from individuals who expressed a general sense of pleasure with the organization are grouped under the category entitled "Pleased with AECT." Typical comments from this category include the following:

- *I am glad to see that AECT is moving forward again.*
- *Keep up the great work...*
- *AECT still has an important role to play in the evolution of technology-based education/training, but perhaps not as an independent society any longer. A merger with AACE or ISPI may be necessary to accomplish what's needed.*

Responses from individuals who expressed their appreciation of the fact that AECT conducted this survey to determine the interests of AECT members are grouped in the category entitled "Like the survey." Typical comments from this category include the following:

- *Can't think of anything...this strikes me as a good survey.*
- *I am pleased to see this survey being done -- it speaks well for the leadership.*

Responses from individuals who felt that AECT was not strong enough in getting positive aspects of the AECT program out to the attention of the membership are included in the category entitled "Marketing needs improvement." Typical comments from this category include the following:

- *Some steady, dependable "marketing" will be needed.*
- *Are you marketing AECT to the school districts? Is AECT represented at library and technology conferences? I do not recall seeing it at those I attend. I hope this helps. Thank you for all the support I have received through AECT.*

Responses from individuals who feel that the general leadership of the AECT has diminished over time and that it needs to be asserted are included in the category entitled "Leadership needs improvement." Typical comments from this category include the following:

- *I want AECT to resume a strong leadership position once more in the field of education & communications technology.*
- *We need to have divisions take a strong leadership role overall and in conference planning specifically.*

Responses that mentioned *ETR&D*, *TechTrends*, or other journals were grouped under the category entitled "Publications." Typical comments from this category include the following:

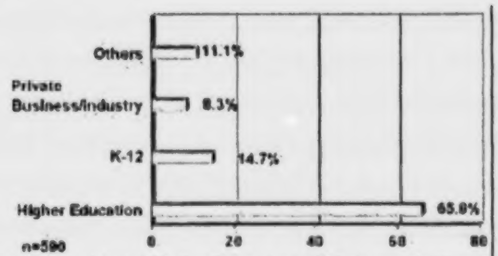
I think ETR&D should publish more variety and a larger number of articles. For example, it should cover more articles related to network-based learning or Web-based learning.

I think we should have more publications, and that we should start a research mentoring program. Also, I would like to see a new journal that focuses on on-line learning. That journal could be on-line.

Findings

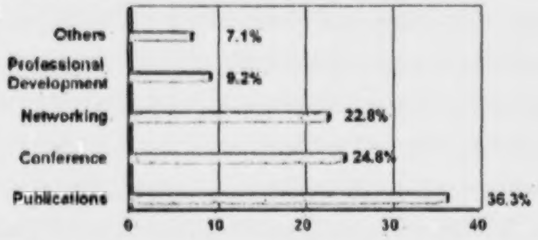
Of the 590 respondents, 487 (82.5%) respondents reported being current members, 47 (8%) respondents reported not being current members and 56 (9.5%) respondents were not certain whether or not they were members ("Not Sure"). With respect to whether or not the respondent resides in the U.S., 563 (95.4%) respondents stated that they reside in the United States while 27 (4.6%) respondents reported residing outside the U.S.

Question 3: What is your employment setting?



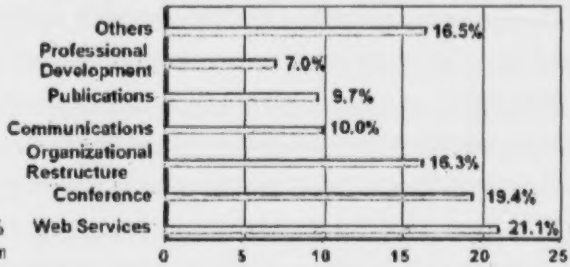
- Approximately two-thirds of the respondents reported Higher Education affiliation, which includes junior/community college or technical institute, college or university campus, or graduate student.

Question 4: What does AECT do for you now that you find most beneficial?



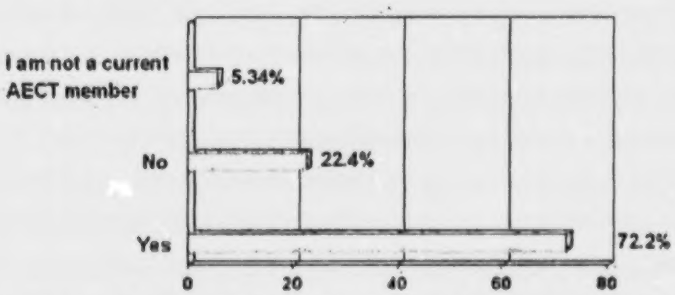
- Respondents identified 4 major areas that were most beneficial. These include Publications, Conferences, Networking, and Professional Development.

Question 5: Please list the most important thing AECT should be doing for you now that it does not currently do.



- Approximately 57% at organizational restructuring as the most importan ime.

Question 6: AECT publishes the following journals-Tech Trends and ETR&D. Have you been receiving your publications in a timely manner?



- Of the 580 survey responses, 419 (72.2%) respondents indicated that they have received the publications in a timely manner. It is interesting to note that 31 respondents chose the item" I am not a current AECT member."

Question 7: How satisfied are you with the quality of recent attitudes in Tech Trends?

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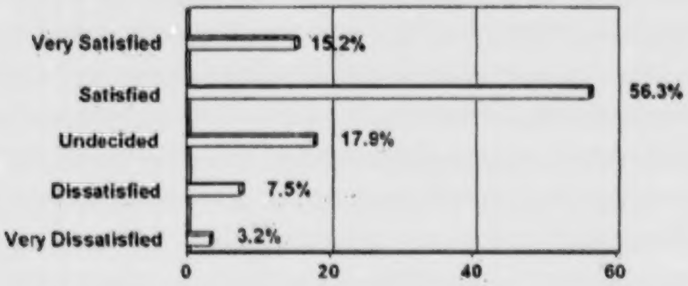
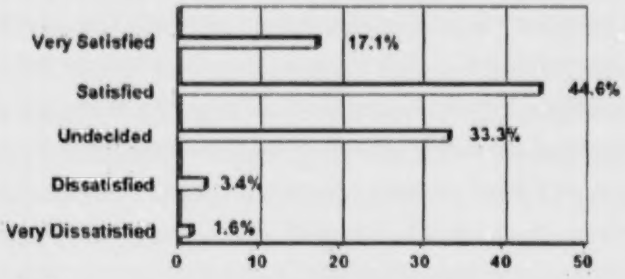


n=560

- Of the 560 survey responses, 400 (71.5%) respondents expressed satisfaction with the quality of recent articles in *TechTrends*. There were 60 respondents (10.7%) expressed some degree of dissatisfaction with the quality of *TechTrends*.

Question 8: How satisfied are you with the quality of recent attitudes in *ETR&D*?



N=439

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- Of the 439 survey responses, 271 (61.7%) respondents expressed satisfaction with the quality of recent articles in *ETR&D*. There were only 22 respondents (5%) who expressed some degree of dissatisfaction with quality of *ETR&D*.
- Approximately one-third of the respondents indicated that they were undecided with regard to their satisfaction of qualities in *ETR&D*.

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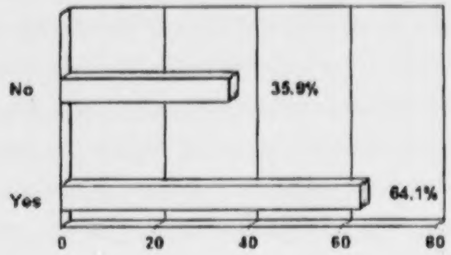
- **Question 9: Have you attended an AECT National Conference within the past 3 years?**



N=585

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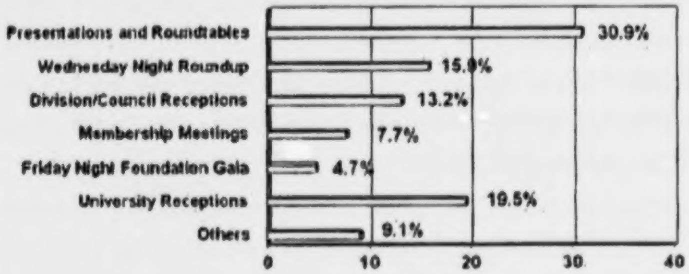
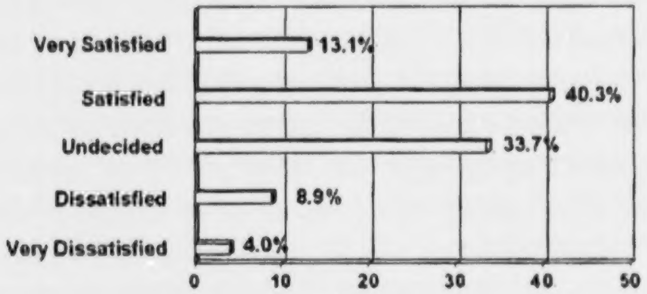
If YES, please indicate which of the following were helpful for meeting people (i.e., networking)?



N=1000

- Respondents addressed the question of what was the most important thing that AECT could do to promote meeting people, the concept of networking with others. Four networking opportunities stood out from the responses, and these included meeting people at presentations and roundtables, the Wednesday night Roundup (AECT Reception at the conference), Division and Council receptions, and University receptions.

Question 10: Were you satisfied with the new online AECT Conference registration service available through the AECT web site?



N=404

- A total of 216 (53.4%) respondents expressed some degree of satisfaction with the online registration.
- Note that almost a third of respondents were undecided with respect to their satisfaction with the online registration service.

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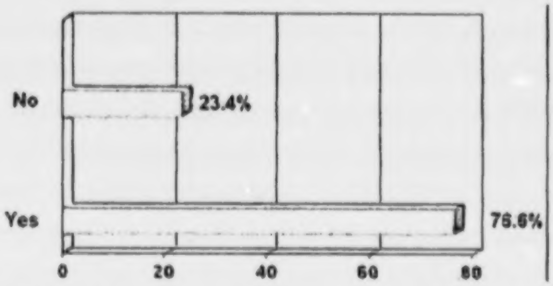
Question 11: AECT changed its conference date from early February to late October, in order to meet concurrently with the National School Board Association, so that AECT members could visit the large trade show. Do you agree with this decision?



n=550

- There was a ratio of approximately three to one among respondents who agreed with the decision to change the date of the AECT conference so that it met concurrently with the National School Board Association (NSBA).
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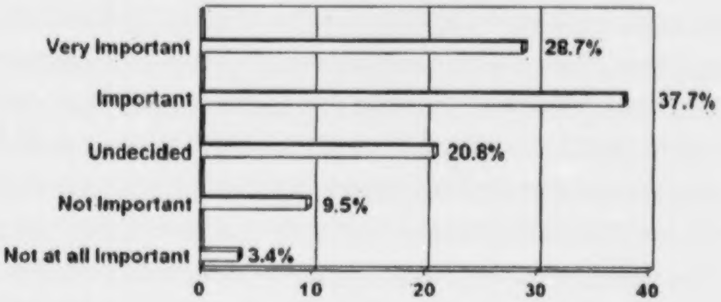
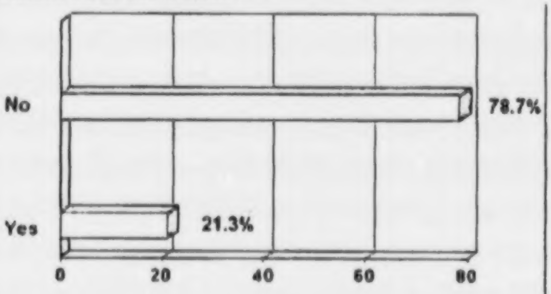
Question 12: How do you feel about the trade show at the AECT Conference?



N=506

- 336 (56.4 %) respondents believed that the trade show is important or very important. **Question 13: Do you know that AECT has recently established a toll-free number?**



N=590

- More than three-fourths of respondents were not aware that the AECT had obtained a toll-free number.

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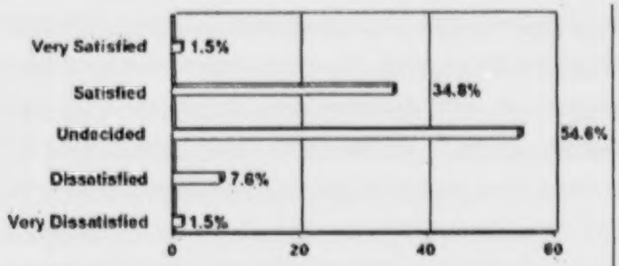
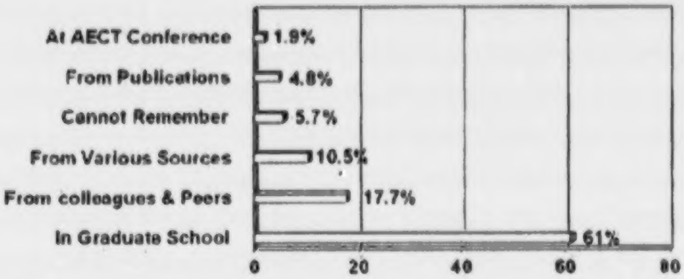
Question 14: AECT made the decision in 1999 to restructure and rename divisions and councils. How do you feel about that?



N=537

- A total of 195 (36.3%) respondents expressed satisfaction with the restructuring efforts. This included 187 (34.8%) respondents who were satisfied and 8 (1.5%) respondents who were very satisfied. It is important to note that a greater percentage of respondents expressed some degree of satisfaction with the restructuring (36.3%) than those who expressed some degree of dissatisfaction with the restructuring efforts (9.1%). A slight majority of respondents expressed neither satisfaction nor dissatisfaction with the restructuring efforts.

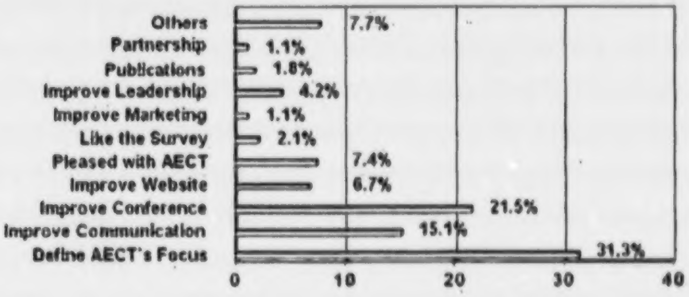
Question 15: How did you first become aware of AECT?



N=559

- The greatest percentage (61%) learned of the organization from their graduate school experience, and 116 of those respondents heard of AECT directly through a graduate school professor.

Question 16: Please list any other comments that would benefit the AECT leadership in determining future directions.



N=559

- Respondents were given the opportunity at the end of the survey to express themselves on any topic that they felt was beneficial to the organization. The largest group (31%) felt that defining AECT's focus is mission critical.
- 15% of respondents felt that AECT needs to improve communication with its members and 22% of respondents felt that improvement is needed in the AECT national conference.

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Discussion

Higher Education

It is important to note the fact that more than half of the respondents are affiliated with higher education at the community college and university level. Of the K-12 respondents to this survey, they often found that there was little of value for them at the trade show in conjunction with the conference. As AECT continues the restructuring process, it will be important to determine the role of K-12 members in the organization. If the association wishes to include the K-12 members in a significant manner, they must examine methods to do so. It is clear that the organizational emphasis is currently on providing services to the majority of their membership, which is involved with Higher Education as evidenced by this survey.

More than half of the membership of AECT joined because of an introduction that occurred during their work in graduate school. Of this, about a third mentioned that they had first heard of the AECT through their professors. AECT's efforts at getting out the word in the graduate schools that teach courses having a technology base seems to pay off in increased membership. Anything that AECT can do, such as giving breaks to graduate students for conference participation or membership, is likely to realize a benefit for the organization as a whole later on.

Conference

AECT members state that they found the conference to be the second greatest benefit of membership. The conference was also stated to be the second highest service that AECT offered requiring improvement. Members were vocal in offering remedies for the conference, and AECT administration would be well advised to examine these comments thoroughly.

Communication

An issue that emerges clearly across all of the survey questions is the issue of communication between the administration of AECT and the membership of the organization.

The issue that is mentioned most often is the frustration of individuals who are unable to receive a response to queries for information. A good example of this is the fact that 9.5% of the individuals to whom this survey was sent were uncertain of their membership status. AECT uses time and resources to contact the individuals who are a part of their database, and it is strongly suggested that they clarify this situation at the earliest opportunity.

Most people were pleased with the online registration services that were available for the conference. There were some important exceptions noted. Of the respondents who mentioned that a purchase order was needed so that their sponsors could pay for registration, it seems that such a service was not offered. Additionally, concern was expressed about the security of the web site and people were uncertain that their personal information would be kept in confidence. AECT might consider explaining the security issue in future registration offerings to address these concerns.

A final issue exists with respect to the online services area. Concern was expressed that the AECT should be a leader in the field of website technology, and many felt that the current website was lacking in information, design, and services. It was mentioned that AECT should spend resources to see that the website would address these issues in a state of the art manner so as to present a model website to the world.

Most people did not know that the AECT has a toll free number. If the Association wants this number to be highly visible, they must consider placement of the number in a visible manner through all of the ways that they contact the membership. This would include the website, email communications, journals, and personal communications.

Publications

AECT publishes two journals, *TechTrends* and *ETR&D*. The first is available with membership and the second only by special subscription. This must be thoroughly explained to all who receive these publications. There was some confusion about these journals at time of this study. Further, publication and delivery of the journals in a timely manner should be a priority to the organization.

Leadership

The task of restructuring AECT to better meet the needs of the membership is not complete, and efforts in this area need to continue. It is essential that restructuring efforts be communicated to the membership of AECT and that the membership must become more actively involved at more stages in the restructuring. If it is at all possible, AECT administration should initiate a quality control action aimed at assuring members that their needs are being addressed.

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Software Developers' Attitudes Toward User-Centered Design

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Abstract

The concepts of usability and user-centered design (UCD) have grown in popularity over the past 20 years as measured by the number of research and mainstream articles devoted to their discussion. As with all new developments, however, there is always the question of how things work in practice compared to theory. A survey on 83 software developers mostly in small-to-medium sized companies in a variety of industries was conducted to examine software developers' views on UCD and usability practices and to illuminate how current practices relate to theory. Results of a descriptive analysis of the 22 Likert-scale attitude question items suggested that respondents had moderately positive attitudes towards UCD activities and discipline. The Likert-scale items were subsequently factor-analyzed and the results suggested that the respondents tended to agree that UCD is worth the effort and cost. They also tended to agree that it is important to conduct many use test sessions and they learned a lot about their products from user test sessions. Software developers who reported that their companies followed important UCD practices were more likely to agree with the view that UCD is worth the effort and cost. Those who have attended usability test sessions were more likely to agree that user test sessions are valuable, and that UCD is worth the effort and cost. However, those who have attended usability test sessions also were more likely to agree that UCD is more work and costs more than conventional development activities. Also, significantly more good usability practices were reported by software developers who worked on teams that either hired usability consultants or had a usability specialist on their teams compared with those who had no usability specialists at all. While software developers held positive attitudes towards UCD, it was notable that they did not report that their companies used practices that are central to UCD. It appears that, while many software developers agree that UCD is a good idea, it tends not to be implemented fully in practice.

Introduction

The concepts of usability and user-centered design (UCD) have grown in popularity over the recent 20 years as measured by the number of research and mainstream articles devoted to their discussion. As with all new developments, however, there is always the question of how things work in practice compared to theory. The opportunities for UCD to have a significant impact on the rapid developments in information technology are infinite in number and will only increase as new technologies emerge. To ensure that this impact is realized, however, organizations must understand how to best organize themselves and their practices to take full advantage of what UCD has to offer.

The purpose of this study is to examine software developers' views on UCD and usability practices in order to illuminate how current practices relate to theory. The results of this study will help researchers and organizations understand what factors are critical to integrating an effective UCD approach in the development lifecycle.

Defining the Concepts

User-centered design is an approach to product development that emphasizes keeping the end user "front and center" throughout the product development process. Unlike the specific techniques and methods that make it up, UCD is a philosophy toward designing products (Norman, 1988), the underlying theme of which is that developers who stay attuned to the concerns, thought processes, habits, and preferences of the people targeted to use their products will develop interfaces and services that are easier to use, have greater utility, and are more enjoyable for their customers (Rubin, 1994).

If UCD is the philosophy that guides an effective development process, usability may be seen as the end result. Once known simply as "user-friendliness" (Norman & Draper, 1986), the concept of usability has attracted much attention over recent years and is currently considered to consist of the following five attributes: (a) learnability, (b) efficiency, (c) memorability, (d) errors, and (e) satisfaction (Nielsen, 1993).

Perhaps one of the most valuable tools in the designer's UCD toolbox is usability testing. This method affords the design team the unique opportunity to observe the actions of the target user population first-hand. Usability testing allows designers to observe authentic users performing authentic tasks and scenarios. While many tests occur in a laboratory environment to make observation and data collection easier, field visits to the users' actual workplaces provide the additional benefit of an authentic context as well.

Dumas and Redish (2000) identify five characteristics that define usability testing:

1. The primary goal is to improve the usability of a product
2. The participants represent real users
3. The participants perform real tasks
4. You observe and record what participants do and say
5. You analyze the data, diagnose the real problems and make recommended changes to fix those problems (p.22).

The Importance of "Getting Close" to Your Users

The activity of "requirements gathering" has long been a core element of the software design process (Boehm, 1988), yet critics of poorly designed software point out that gathering requirements through focus group discussions or by talking to management often fails to identify what is needed to make a usable product. The only way to accurately define what people will be able to use is to gather information *directly from the users themselves*. As with so many things in life, however, all user-centered design activities are not created equal. Some methods are more successful than others at bringing users and designers close together.

It would seem that the simplest way of gathering information from users is to ask them what they want. Unfortunately, we know that users do not always know what they want. Indeed, Andre & Wickens (1995) cite a host of studies demonstrating that users not only don't know what they want, but that they frequently make bad choices as well. In one study of six different interface designs, users consistently indicated a preference for those designs that they performed most poorly on (Bailey, 1995). The results emphasize how important it is to include empirical data on performances in addition to asking users what they like.

Conducting needs analysis interviews and performing content sorting activities with users have also been found to bring users and designers closer together (Corry, Frick, & Hansen, 1997). These activities have the added benefit of being able to be performed early in the design process, allowing multiple iterations to follow.

Low-fidelity or paper prototyping is a technique that involves users early in the design process (Sugar & Boling, 1995) and has been shown to be just as effective as prototyping exercises that employ a more completed electronic version (Virzi, Sokolov, & Karos, 1996). The fact that paper prototypes of a computer system interface are obviously unfinished allows users to freely comment and contribute their ideas for improvement to designers (Datz-Kauffold & Henry, 2000).

Testing electronic prototypes or even an fully functioning system has certain advantages over low-fidelity prototyping. On-screen interactions no longer need to be simulated and colors, resolution, modes, and system operating speed can be evaluated more accurately. Misanchuk, Schwier, & Boling (2000) describe how usability testing the working version of an electronic book on instructional multimedia led to the discovery of multiple, desirable features that were missing.

Often, there are factors affecting usability that cannot be observed in a lab or test environment. Contextual inquiry (Beyer & Holtzblatt, 1998) attempts to overcome this problem by having designers observe users in their natural work environment in order to fully consider the many variables that may influence how a product is ultimately used.

Inviting users to participate on the actual design team is another strategy for bringing users and designers close together. Known as participatory design, this approach typically has designers and users work side by side throughout the development cycle. Benefits of participatory design have been shown to include a sense of ownership among users and an increased understanding of users by designers (Williams & Traynor, 1994). Clement & Van den Besselaar (1993) stress, however, that for participatory design efforts to succeed, users must be allowed to take an independent position on problems and they must participate in the process of decision making.

The Current State of Practices and Attitudes

While much has been studied and written regarding usability evaluation methods and design practices, very little work has been done in determining actual practices and attitudes of those in industry. Gould & Lewis (1985) surveyed 447 software developers attending a human factors workshop to see whether they identified three basic principles of designing for usability as a common part of their own design processes. The principles included an early and continual focus on users and tasks, empirical measurement, and iterative design. The results revealed that developers either did not identify with the three principles or did not understand them well enough to implement them as intended.

In another survey of current practices at the time, Dillon, Sweeney, & Maguire (1993) conducted a survey of the software industry in the United Kingdom, gathering data on four themes: respondents' backgrounds, their interpretation and appreciation of the concept of usability, current practice with regard to usability evaluation, and problems and requirements for support in conducting usability evaluations. The authors found a widespread awareness of usability among respondents, but what seemed to be only a superficial application of Human Factors methods.

Differences in attitudes toward usability were considered in a study that combined survey and qualitative interview research of three Management Information System (MIS) managers and 125 end-users of commercial software systems (Morris & Dillon, 1996). Interviews with the managers revealed an emphasis on costs and system features when designing or selecting new technologies for their organizations. This was in significant contrast to users' main concerns of contextual and environmental issues that affect the software's usability.

Methodology

The following questions were considered during the course of this investigation: What are software developers' attitudes toward user-centered design? What are the actual methods utilized by software developers who report using UCD? Does there exist any correlation between the practice of user-centered methods and developers' attitudes?

Data Collection

Three survey forms were sent to each of 500 software companies (1,500 forms). The companies that the survey forms were sent to were selected from the Software Publishers Association membership directory. The survey forms were comprised of questions concerning the respondents job classification (type of software designer), type of training (if any) in usability, history of participation in usability tests, types of usability procedures utilized by respondents, size of the company the respondent worked for, and attitudes concerning usability testing. Most of the questions required respondents to check boxes indicating the appropriate answer, except for the attitude questions which contained 22 question items measuring the subjects' response to a given statement. These items were measured on a five-point Likert scale from strong disagreement to strong agreement.

Subjects

Eighty-three software developers responded to our survey. This was an effective return rate of 5.5 percent.

Results of the Study

Descriptive Analysis for Software Developers' Current Practices of UCD

(1) Respondents' Position as a Software Developer

As shown in Table 1, the majority of respondents worked in commercial applications, instructional software, and entertainment software. Software developers who belonged to the above three positions accounted for 86 percent of the respondents.

Table 1. Software developers' Position

Position	Frequency
Commercial applications	33
Instructional software	24
Entertainment software	14
Other	9
Technical/programming language	1
Instructional and Entertainment	1
Online and Commercial	1
Operating systems	0
Online documentation/help	0
Total	83

(2) Companies that Participated in the Survey

Among the 500 companies to which the mail surveys were sent out, results were returned from 56 different companies. Most of the companies participated in the survey had one person respond; whereas 17 companies surveyed had 2-3 software developers respond.

(3) Number of Employees in the Company

More than half of the respondents (55%) worked in companies with 1-50 employees, and about a quarter of the respondents worked in companies with 51-250 employees. The remaining 18 percent worked in companies with greater than 251 employees. Thus, most of the respondents (82%) worked in smaller companies, with less than 250 employees.

(4) Number of People Assigned to Software Development Team

More than half of the respondents worked in core development teams with 4 - 8 members, and about one-third of the respondents worked on teams of 3 or less. Relatively few respondents (10%) worked on larger teams with more than 8 members.

(5) Company' Expectation on Usability in Their Products

Eighty-two percent of those surveyed reported that their company always expected their software development teams to ensure usability in their products. Seventeen percent indicated that their companies sometimes had such expectations. No respondent indicated that such an expectation did not exist in his or her company.

(6) Use of Specific Process for Incorporating UCD into Product Development

Thirty-seven percent of the respondents answered that their companies always used UCD processes in their product development, and 47 percent responded their companies used UCD processes sometimes. Meanwhile, 14 percent indicated their companies never had such a process in their software development. Thus, it can be seen that the majority of the respondents reported that their companies used specific UCD processes for software development.

(7) Experience in UCD Practice for Software Development

Respondents had an average of approximately 4 years of experience in UCD practice (M= 4.02, SD=1.70), ranging from 0 to over 7 years. More than half of the respondents indicated that they have practiced UCD 1 -7 years.

(8) Experiences in Attending User Test Sessions

For the question asking for their experiences in attending user test sessions, 80 percent of respondents indicated that they had attended at least more than one user test session. In contrast, 20 percent responded that they had never attended user test sessions. There was considerable dispersion in the reported number of times that they attended user test sessions, ranging from 1 to 100 test sessions.

(9) Experiences in Helping Conduct User Test Session

Sixty-four percent indicated that they helped conduct a user test session more than once, while 36 percent answered they never helped conduct user test sessions. Those who had conducted user test sessions themselves reported widely dispersed occurrences, ranging between 1 and 200 times.

(10) Software Development Activities Being Practiced

Respondents were asked to check all of the kinds of activities in which their companies were engaged in developing their products. These activities were ranked according to how frequently they were mentioned by the respondents in Table 2. "Using common sense" was most frequently checked (77), while "using constructive interaction techniques" was least frequently indicated (18). These activities were coded with +, 0, and – by the investigators (the respondents did not see these codes). A "+" activity means that the user is actively involved in the software development process. A "–" activity indicates that the user is not involved in the process. A "0" activity means a user is somewhat involved or neutral. The median split from Table 2 reveals that the majority of the activities above the median do not involve users in the design process (7 out of 9), and the 4 activities in which users actively participated ranked among the bottom 6 (below the median).

Table 2. Software Development Activities Reported to Be Practiced

Code*	Development Activities	Number of Responses
-	Using common sense	77 (top ranking)
-	Setting major goals	67
0	Using computer prototypes	65
-	Interviewing representative users and asking whether they like the product	63
-	Soliciting feedback from "seed sites" or "beta-testers"	62
-	Performing competitive analyses of competing products	58
0	Testing out major design issues with users	58
-	Following GUI guidelines	58
-	Following standard interface guidelines	56
-	Passing screen shots to other developers	50 (median ranking)
0	Using paper prototypes	44
-	Following company's interface guidelines	43
-	Expert walkthroughs	39
+	Doing field studies/visits of user's work environments	38
+	Having a real user on the design team	29
0	Performing task analysis of user's tasks	27
0	Recording user's actions with a program	25
+	Using think-aloud protocols	22
+	Using constructive interaction techniques	18 (lowest ranking)

* + indicates the user is actively involved in the software development process.
- indicates the user is not involved in the software development process.
0 indicates a user is somewhat involved or neutral to the development process.

(11) Attending Formal Training in Usability and Sources of Training

Less than one-third of the respondents indicated that they had any formal training in usability; the remaining 70 percent reported not having attended any formal training in usability. When asked their sources for obtaining training in usability – including informal types of training – the respondents were most likely to get their training from books/journals, and conferences/workshops.

(12) Accessibility to a Usability Specialist

Sixty percent of those surveyed answered that their development teams did not have access to usability specialists. On the other hand, 17 percent had access to usability consultants, and 17 percent had a specialist on their team; thus, one-third of respondents indicated having access to usability specialists.

Software Developers' Attitudes Towards UCD

(1) Factor Analysis

A factor analysis of the 22 Likert-scale attitude questions was conducted using the image factoring method with varimax rotation, resulting in seven factors as shown in Table 3. In addition, a reliability analysis on each factor was conducted

(Cronbach's α for internal consistency). The Likert-scale values of the items that had negative loadings on a factor were reversed when factor scores were computed. Results of the reliability analyses ranged from .5952 to .7784 (see Table 3).

Table 3. Results of Factor Analysis and Reliability Analysis

Factor	Items	Reliability coefficient
1. User-centered design (UCD) is more work and costs more.	16. My team's UCD activities tend to lengthen development time for our product. 5. The UCD activities that I have participated in did not generally add time to product development cycle.* 13. UCD is more expensive than traditional product development. 1. UCD activities make extra work for me as a developer.	α = .7784 (n = 74)
2. User test sessions are valuable.	14. Participating in user test sessions is a positive experience. 21. Overall, I do not enjoy participating in user test sessions.* 18. I usually have confidence in the results of user test sessions.	α = .7554 (n = 74)
3. Epiphany: experience of UCD changed my mind.	2. Users in the test lab behave just the way I expected them to before I started attending user test sessions.* 15. Once I became involved with UCD activities, I changed my mind about what UCD is. 17. After the first user test session I observed, I found that I had an altered view on my users.	α = .6438 (n = 59)
4. Learned little from user tests and UCD.	3. User test sessions usually do not give me new insights about my program. 11. Participating in UCD activities had little effect on my understanding of this discipline.	α = .5952 (n = 67)
5. Many tests important, learned a lot about my product.	10. It is important to conduct user test sessions many times throughout product development. 12. I usually learn a lot about my product as a result of user test sessions.	α = .605 (n = 74)
6. UCD is worth the effort and cost.	8. In general, I would not recommend that other development teams spend effort on UCD activities.* 6. In my opinion, UCD activities are worth the effort. 7. The expenses incurred by UCD activities are offset by savings elsewhere in the development process or life-cycle of the product. 9. In my development work, I find that the extra time it takes for UCD activities does not frequently enhance my products.*	α = .574 (n = 77)
7. Usability specialists are helpful in improving product.	19. Most usability specialists are primarily interested in improving the overall quality of my program. 4, Usability specialists do not do much except point out the "mistakes" of my programs.*	α = .641 (n = 57)

*These items negatively loaded on a factor, and were reverse-coded when computing scale scores for each factor.

(2) General Attitude

Results of a descriptive analysis of the Likert-scale attitude questions suggest that the respondents had moderately positive attitude towards UCD activities (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree). As seen in Table 4, the respondents tend to strongly agree that UCD is worth the effort and cost (M= 4.38, SD= .48). They also tend to strongly agree that it is important to conduct many user test sessions and that they learned a lot about their products from user test sessions (M= 4.11, SD= .68). Likewise, respondents tend to disagree that they learned little from user test sessions and UCD (M= 1.77, SD= .66). The overall mean was 3.79, which suggests moderately positive attitude towards usability.

Table 4. Descriptive Statistics for the UCD Attitude Factors

Factor	N	Minimum	Maximum	Mean	SD
1. User-centered design (UCD) is more work and costs more.	74	1.25	5.00	3.15	.94
2. User test sessions are valuable.	74	2.00	5.00	3.90	.61
3.Eiphany: experience of UCD changed my mind.	59	2.00	5.00	3.51	.69
4. Learned little from user tests and UCD.	67	1.00	4.50	1.77	.66
5. Many tests important, learned a lot about my product.	74	2.00	5.00	4.11	.68
6. UCD is worth the effort and cost.	77	3.00	5.00	4.38	.48

7. Usability specialists are helpful in improving product.	57	2.00	5.00	3.95	.78
Overall attitude	45	3.05	4.91	3.79	.37

(3) UCD Practices and Attitudes

Point-biserial correlations were done between the user-active UCD methods (presented in Table 2 with the + codes) and the 7 components of user attitudes toward UCD (presented in Tables 3 and 4). None of these correlations was significant at the 0.05 level. A new variable, "good UCD practices," was then constructed by totaling the number of items checked from the following practices: 1) testing out major design issues with users, 2) doing field studies/visits of users' work environment, 3) using paper prototypes, 4) using computer prototypes, 5) using think-aloud protocols, and 6) recording users' actions with a program. A significant positive correlation was found between the number of "good UCD practices" and the software developer attitude that "UCD is worth the effort and cost" ($r = .235$, $p < .05$). However, none of the other six UCD attitudes was significantly correlated with the number of "good UCD practices," nor was the overall attitude towards UCD correlated with the number of "good UCD practices."

(4) Developers' Background and their Attitudes

1. Position and Company Size

An analysis of variance (ANOVA) was conducted to see if there were any differences in UCD attitudes according to software developer position. Results showed that instructional software developers more strongly agreed that "user test sessions are valuable" than commercial applications software developers ($F = 6.874$, $p < .002$). Furthermore, instructional software developers tended to more strongly *disagree* that they learned little from user test sessions and UCD than did entertainment software developers ($F = 3.618$, $p < .033$). However, no significant difference was found among the software developer positions and their overall attitude towards usability ($F = 2.471$, $p = .098$). Also, there was no difference in attitudes towards UCD according to size of company ($F = 1.164$, $p = .341$).

2. Formal Training in Usability

Results of an ANOVA showed that there was no significant difference in the respondents' attitudes towards usability between the group who have had any formal training in usability and those who have not received any formal training in usability ($F = .213$, $p = .647$).

3. Experiences in User Test Sessions

Results of an ANOVA revealed that those who have attended user test sessions tend to more strongly agree that "user test sessions are valuable" ($F = 3.934$, $p= .051$), and that "it is important to conduct many user test sessions and they have learned a lot about their products from the user test sessions" ($F = 3.337$, $p = .072$). However, those who have attended user test sessions also tend to more strongly agree that UCD is "more work and costs more" than conventional development activities ($F = 4.634$, $p = .035$). In addition, those who have experience in helping conduct the user test session also tend to more strongly agree that "UCD is worth the effort and cost" ($F = 5.555$, $p = .021$) than those who have no such experience.

4. Access to Usability Specialists and the Developer's "Good UCD Practices

An ANOVA was conducted between the group who had a usability specialist either in their team or as a consultant and those who had no access to a usability specialist in order to compare the number of "good UCD practices" between those two groups. The results showed that significantly more good UCD practices were reported by software developers who worked on teams that either hired usability consultants or had a usability specialist on their teams compared with those who had no usability specialists at all ($F = 10.047$, $p = .002$). The means for each group was 3.9 for the group who had access to usability specialists, and 2.7 for the group who had no such access, respectively.

Discussion

___Results suggested that while the respondents considered the UCD process more work and additional cost, they viewed UCD as a positive, worthwhile practice. The software developers who attended user test sessions and helped conduct sessions reported more positive attitudes than others. This would suggest that active participation in usability tests may be a factor in developers' positive outlook concerning usability tests.

We were intrigued, however, with the apparent lack of findings in many of the areas for which we performed analyses. For example, we had expected attitude differences between those who have had formal training in UCD and those who have not. No difference in attitude was found.

Most intriguing, however, was the software developers' apparent lack of use "good UCD practices." That is, while the respondents reported UCD as a positive and beneficial practice, this was not correlated with reported numbers of good UCD practices.

Perhaps most important is having a usability specialist either as a consultant or as a team member, since this is associated with greater numbers of good UCD practices. Given that only 30 percent of software developers have received any formal training in usability -- and when they did, it was most likely from books and journals -- it appears worthwhile to have usability specialists on the development team.

Finally, this study is limited by the generalizability of its findings. We do not know if those who responded to the survey are representative of software developers in general. Also, our data were collected in 1994-96, and it is possible that software developers' attitudes and their company's UCD practices may have changed since then. However, our results seem to be consistent, in part, with a recent survey of HCI professionals in North American industry in which respondents were asked to identify what organizational approaches and usability methodologies they perceived to be most effective in having a strategic impact on corporate decision-making (Rosenbaum, Rohn, & Humburg, 2000). The size and type of company along with the size of the usability group within it were all considered, but no statistically significant relationships proved to exist between the demographic data and the organizational approaches and usability methods employed. In our study, we found no relationship between software developers' attitudes toward user-centered design and good UCD practices.

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Transforming a Lecture-Based Course to an Internet-Based Course: A Case Study

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Abstract

The rapid increase in the use of computer technology to facilitate alternative forms of educational delivery, often called distance education (DE), represents a major change taking place in education. The potential for decoupling the traditional requirements that student and teacher be present in the same room at the same time has never been greater.

Many teachers will soon decide to design, or be asked to design, courses for distance education in virtual environments for the first time, but they will not have many published principles to guide them. This research project, which represents portions of my doctoral dissertation, describes an instrumental qualitative case study examining the process that an educator must resolve when designing a distance education course from a preexisting traditional course. My research focused on the transformation of a widely-taken, lecture-based course to a largely asynchronous, web-based course.

During this study, the principal guiding question was: What aspects of content, design, and andragogy would an instructor consider when transforming a lecture-based course to one incorporating web-based instruction? In addition to this overarching question, a number of related questions regarding the selection of team experts and devising suitable methods for regulating student—student and teacher—student interactions were considered.

A number of key themes and issues manifested themselves during the course transformation process, primarily those concerned with unexpected problems and technical difficulties, and those focused on the pedagogical novelty involved with distance education.

The course displayed far fewer technical problems than anyone might have imagined. However, issues regarding teacher evaluation and the possible consequences for tenure evaluation were totally unexpected by the principals involved. The issues surrounding the newness of distance education, for both student and instructor, demonstrated enormous complexity. Pedagogical matters on how time and space affected the course, on what "interacting" means in a distance education environment, and the new varieties of limitations and constraints imposed by distance education must be considered by future dstance education instructors.

Background

As we approach the new millennium, all objective signs point to the fact that education, as well as a number of other social institutions, appear to be undergoing radical transformation. These changes may involve all levels of the educational system from pre-kindergarten through higher education. Many believe that these upcoming changes will inaugurate the greatest systematic modifications since the Middle Ages, when universities shifted fundamentally from locations that congregated assemblies of great scholars and thinkers to those seeking to become great repositories of the latest technological education innovation: the printing press and books (Nyiri, 1997).

One major change taking place in education is the rapid introduction of computer-assisted educational delivery, often called distance education (DE). Other terms for distance education, such as "open learning," "distributed learning," "web-based instruction," and "flexible learning," have also been used, and these terms often compete and substitute for one another indiscriminately. Many of these terms show subtle distinctions that can best be discerned by considering the environment and the frame of reference used by the institution offering the instruction.

Regardless of the particular variety, distance education platforms all share a number of characteristics in common (Peters, 1993): (a) teachers and students are apart; (b) the learning often takes place in the home of the student; (c) the teaching-learning process often takes the form, or uses components of, independent study; (d) students do not have to cease working or interrupt their schedule while taking the course.

Our contemporary variations of distance education incorporate the newest technologies of computer networks and modern telecommunications. With the advent of these new advancements, the potential for decoupling the traditional requirements that student and teacher be present in the same room at the same time has never been greater. From an operational point of view, distance education can be thought of as a set of variations in the educational processes and technologies that take place without these conventional requirements.

Today three different types of technologies tend to dominate in distance education: videoconferencing, interactive broadcasting, and online formats. Videoconferencing and broadcasting generally require that the participants meet at the same time although the location of the participants may vary considerably—from different sites on the same campus to different cities, states, or even countries. This variety is called synchronous distance education (SDE). In the latter technology, called asynchronous distance education (ADE), the participants are constrained by neither time nor location. The increasing trend among distance educators involves integrating multiple platforms to maximize the benefits of each method of delivery. This study followed a team as they developed a largely ADE course for Internet delivery.

While distance education has existed in its many forms for more than a century, it has never played a major role until recently (Barley, 1999; Martin, 1999). This may soon change since the ability to reach students previously cut off from the traditional face-to-face, lecture style of education has excited many educators and politicians alike.

The United States Department of Education recently began tracking the availability of distance education courses in higher education (Lewis, Alexander, & Farris, 1998; Lewis, Snow, Farris, Levin, & Greene, 2000). They reported that for the 1995 fall term approximately 58% of 2-year public higher education facilities and 62% of 4-year institutions offered distance education classes. Overall about 33% of institutions offered distance education courses. Their next survey covered data for post secondary education institutions for the 1997-1998 school year (Lewis, et al, 2000). Among public 2-year institutions, now 62% offered distance education courses, while public 4-year institutions offering distance education courses rose to 78%. As in the previous survey, private institutions lagged behind public institutions, with only 5% of 2-year private schools and 19% of 4-year programs offering distance education courses. The trend for increasing use of distance education in the near term is clearly escalating.

Private institutions have reacted differently from public ones. In 2year private institutions only 2% offered distance education courses, and only 12% of 4-year institutions offered distance education courses. Many of these elite campuses have taken a more selective approach and focused on specialized degree programs and curricula that can be exported to international audiences without interfering their local, on-campus strategies (Blumenstyk, 1997). As the United States currently undergoes its massive build-up in the race to embrace distance education technologies within its educational systems, questions regarding the effectiveness and best practices of distance education remain unanswered and often even unasked.

While many different forms of distance education varieties are being tried across the country, using the Internet as a delivery vehicle has become increasingly popular. In the United States, college courses have increased their use of e-mail from 8% in 1994 to 44% in 1998, and the use of other Internet resources and World Wide Web (WWW) pages for class materials also show dramatic increases (Institute for Higher Education, 1999). In 1998, the United States Department of Education found that 1,680 institutions offered 54,000 distance education courses, with 1.6 million students enrolled (Carnevale, 2000). This growth is all the more amazing when considering that, except for a small number of experimental courses, the number of such courses offered in 1995 approached zero. A probable reason for this may have been the fact that browsers and other software tools only existed in primitive forms until recently.

The true number of distance education courses offered is presently unknown, however. Criteria have yet to be established on what should be considered a distance education course. For example, in some colleges, courses simply having a syllabus available on-line would qualify as a distance education course. In the very near future, some method of assigning an approximate percentage of the course that takes place via distance education will have to be devised.

Many teachers will be designing courses for distance education environments for the first time, and they will be doing so for a variety of reasons. Some will offer their courses in this manner because it appeals to them out of curiosity or because they are personally interested in the technological innovations and want to experience them first hand. Others believe the new technologies may improve or enhance their current courses by offering students new ways of looking at, or contemplating, a problem, or a new way of thinking. Many will be offering their courses for less than optimal reasons. Administrators, desiring to reach as many students as possible, might pressure them to take their courses online. To accomplish this, they may want to add some form of distance education to supplement their traditional student base. Some administrators will want their institutions to be seen as leaders of the field or simply may not want to be seen as laggards, out-done by their competitors (Martin, 1999). Whether these teachers will be transforming their existing, traditional courses or designing new courses *de integro*, they often will be uncertain as how to proceed.

To many of the "early adopter" educators, those first to undertake distance education in their classes, their efforts often focus on transferring as much as possible from what they have already prepared for their traditional classes without consciously adapting their materials to these new media. While this may be an obvious first approach, it cannot be as effective as when instructors completely rethink and reevaluate the advantages and disadvantages of the new medium. The most effective distance education educators will focus on which specific distance education options are the most appropriate for their given curricula.

As part of my case study, I met and interviewed Dr. Gwendolyn and other principals throughout the course development process. I observed how she approached the transformation process and how she evaluated which changes needed to take place in the newly transformed course. I observed how and why decisions were made regarding course content, student-faculty interactions, and student-student interactions. I also followed how she interacted with the instructional technologists who helped her give shape to the on-line course in the form of text, audio, graphics, animation, and video media. I was given access to all content meetings and was allowed to observe the group decision-making process and how they delegated tasks and made assignments.

Research Overview

A department within the business school of a large southern, urban university began their experimentation of offering web-based instruction by granting Dr. Wolf release time to develop an online course. The department heads selected a graduate gateway course for the experiment, i.e., an introductory class required of all incoming graduate students within that department. The course also acts as a pre-requisite for many other graduate courses within the entire business school.

Cast of Characters

The primary members in this research effort included: Dr. Wolf, Dr. Gwendolyn, Dr. Summerville, Mr. Masterson, and Ms. Veritago. Each person brought unique skills to the process as tabulated below. Dr. Wolf assumed the chief responsibility for the course content and would teach the class when completed. Dr. Gwendolyn acted as team coordinator for both phases of the project as well as the instructional designer for the course. Dr. Summerville contributed greatly as a subject matter expert. Dr. Wolf, Dr. Gwendolyn, and Dr. Summerville acted as the principal content team during the development phase of the project. Mr. Masterson and Ms. Veritago joined Drs. Gwendolyn and Wolf in the second phase of the project and contributed largely as web-page designers and to web site maintenance.

The Transformation Process

In the first phase of the process, the team examined the course material for two primary considerations: the relevance of the subject matter for the current demands of the field and the suitability of the course material for use in a web-delivered environment. Drs. Wolf, Gwendolyn, and Summerville presided over this "transformation phase" of the project.

Administration

According to Dr. Wolf, his department cited several reasons for wanting to experiment with distance education within their programs. While the business college boasts an excellent reputation and usually attracts more student applications than available open slots, some problems were beginning to emerge. The reasons for undertaking the course transformation are summarized in the table below.

Table 1 Summary of Dr. Wolf's Department's Reasons for Developing DE Courses

Stakeholders	Reasons for participating in DE Courses
Students	None directly solicited
Faculty	Increasing travel demands Potential for improving courses
Administration	Perceived demand by students Increase the number of students per class Perceived competition by other college programs offering DE courses Reduce time and space constraints for students attending college courses Reduce traffic and parking congestion on campus

Students

In preparation for overseeing the transformation of the course, Dr. Gwendolyn formulated a 12-step program for implementing the transformation of the course from a lecture-based format to an Internet-based format. She relied heavily on her TWIGS (tools for web-based instruction: generating structures) concepts, generated from her previous research and experience designing distance courses, to guide Drs. Wolf and Summerville in reviewing the course materials for suitability in the new educational medium.

The TWIGS document guided the instructors to design their distance education course to the needs and requirements of the students by posing a series of questions in a number of different areas. One of the difficulties with the course in question related to the very different technological skills that students bring to the course: some are technological neophytes and others are technological experts. In general the students were pursuing their MBAs, in their twenties, worked full-time, and had several years of "real world" business experience. Some of the students would be of foreign birth and not speak English as their native language.

Instructors

For approximately five months, Drs. Wolf and Gwendolyn accepted the challenge of designing a web-based course based on a course that had been traditionally taught in a face-to-face manner. Drs. Wolf and Summerville, acting in their roles of subject matter experts, carefully reviewed every topic in past course syllabi to determine if the material continued to be necessary and vital for students in the field to understand and master. They worked with Dr. Summerville to review the content of the course and make certain each element of the syllabus remained important and relevant given the rapid changes that are taking place in real-world business environments. Under Dr. Gwendolyn's guidance, the team reviewed the course syllabus; considered under what parameters the students would access the Internet and how that might affect their course design; discussed the number and types of tests that would be used; and reviewed which communication features—synchronous, asynchronous, or both—the course would incorporate.

The principals agreed to incorporate both synchronous and asynchronous components of distance education. Dr. Gwendolyn pointed out that too much time devoted to SDE would take away many of the advantages of distance education, in general, by tethering the students to their computers at certain times. This was especially relevant to the given student population since so many of them worked full time.

In the process the course material underwent drastic changes. During this process, they did not take into account the suitability of the material for distance education delivery, and it fell upon Dr. Gwendolyn to accommodate as much of the content and style of presentation as possible and to let them know if she believed changes needed to be made to suit the medium.

Design Process

During the last stage of the course development, what I call the Design Process, the content of the course had already been determined, and the team now focused on how what type of course management software would be used and the graphic design and style of the web pages. Dr. Gwendolyn proposed three possible options for web course management software: use a pre-existing, off-the-shelf product such as WebCT or Blackboard.com, design a proprietary, custom-made software, or a hybrid solution of modifying the commercially available software to best suit Dr. Wolf's needs. Each option offered strengths and weaknesses. The commercial software would be the easiest to use, but it would also be the most rigid, forcing any instructor to utilize preformed templates. The proprietary software would allow instructors nearly unlimited freedom in how their course materials would be presented and how students would interact with the material, but it would be the most difficult to design, would be difficult to maintain, and would not allow other faculty members within the department an easy template to copy for their courses. Dr. Wolf decided to employ the hybrid solution as providing some flexibility but still allowing those within the department some guiding design prospects.

Dr. Gwendolyn had three main goals for her design principles for the course: (a) accommodate the instructor's style of teaching as much as possible; (b) provide a relatively easy to use model for other instructor in Dr. Wolf's department to emulate should they decide to transform classes of their own; (c) adhere to standard graphic design principles to maximize ease of reading of text and viewing of graphics.

Mr. Masterson and Ms. Veritago reviewed Dr. Wolf's class notes and PowerPoint slides and redesigned them for consistency of appearance and legibility. These style guides would apply to all documents on the web site. Dr. Wolf was pleased with the results.

The design team incorporated several features within the web page that Dr. Wolf found useful for this course and for possible improvements for future courses. They used time-sensitive coding so that answers to assignments and exercises only appeared after a given date. "Page tracking" offered the possibility of tracking which web pages were utilized by students the most. This feature offered an indirect measure of which parts of the web site the students found the most useful.

Attempts to have outside evaluators review the web site did not produce as much information as hoped for. Dr. Summerville's face-to-face class looked at the course prototype but only provided a small number of comments. Other instructors in other institutions had agreed to review the website but because of time conflicts only provided very basic comments.

Discussion

As long as I've got an IP connection, I've got a classroom.
—Dr. Summerville

This stuff will eat you alive—if you let it.
—Dr. Gwendolyn

A number of key themes and issues manifested themselves during the course migration process, and I have grouped them into two categories: those concerned with unexpected problems and technical difficulties, and those focused on the pedagogical novelty involved with distance education.

Technical Difficulties

The course displayed far fewer technical problems than either Dr. Gwendolyn or Dr. Wolf imagined—they both expected far worse and doubted other instructors would be so fortunate. The one major problem of students being kicked off the chat room site when another student entered continued throughout the term was never resolved. For the next term, Dr. Wolf ported the course into WebCT, and the problem never recurred.

Instructor Evaluations and Tenure

As with many other universities, Dr. Wolf's department uses student evaluation of instructors as part of their protocol for determining academic tenure. His particular department makes use of a series of questions that students rank on a 5-point scale, with one being the lowest score and five the highest score. Dr. Wolf was surprised by the relatively negative student evaluations he received at the end of the course. His scores averaged 0.5 points lower than his usual scores. While many of these comments might be attributed to the fact that he was teaching the course for the first time, it is equally possible that many of his low scores might be attributed to the fact that the students were given a traditional, face-to-face instructor evaluation form to fill out. The form contained a number of inappropriate questions that might have confused the students or possibly caused them to give less careful consideration to the process than they might have under different circumstances. For example, Question 4 asks if the instructor "is accessible to students out of class," and Question 6 asks if the instructor "speaks in a manner that is easy to understand." While only a handful of the 37 questions appearing on the evaluation form might be considered totally irrelevant, more than one-third of the questions have either little relevance to courses taught at-a-distance or would have to be modified or clarified in some manner to better accommodate the circumstances involved in the new environment.

Dr. Gwendolyn's department, at her university, requires that she use traditional evaluation forms for her online classes, but she augments that data by asking her students to fill out an evaluation form of her own design. This simple solution might have salvaged a better review for Dr. Wolf and made the entire experience more rewarding for him.

As a by-product of the instructor evaluation disappointment, Dr. Wolf raised the issue of tenure evaluation. As an assistant professor, Dr. Wolf felt he must keenly focus on areas related to tenure. The department establishes requirements for tenure, some of which are explicitly recorded and some that are more nebulous and subjective. Since teaching distance education courses generally requires more effort than traditional courses, yet does not generate extra rewards for that effort, Dr. Wolf decided he no longer wanted to teach them at this stage in his career. He felt the potential for lower evaluations could not justify the extra effort involved. Dr. Wolf thought the department should offer bonuses, in the form of release time or other similar benefits, to instructors offering to teach online.

Intellectual Property Rights

While the debate over who owns the rights to distance education courses rages on in a number of universities (Noble, 1998a), only one of the principals, Dr. Summerville, voiced any concern over the controversy. Neither Dr. Wolf nor Dr. Gwendolyn expressed the slightest concern over the matter, but I believe the subject should be discussed and given careful consideration. At the present time, the issue may not be that important since most of the instructors involved in distance education pursue distance education for their own interests and curiosities. However, as the push towards distance education continues, and universities become more insistent that their instructors offer distance education courses, the matter might not be so benign.

Thus, while the issues of intellectual property rights and ownership have not played a role in the current course transformation, I believe it is an issue of extreme importance. Future distance education instructors may wish to investigate this matter when the time comes for their initiation into teaching at-a-distance.

Redefining Time and Space Within a Distance Education Environment

As stated earlier, distance education can be thought of as a set of educational policies and technologies that allow both the student and instructor to be separated in time, space, or both time and space. The process of transforming this graduate course involved a number of stages, and many of them related to issues of time and space, either directly or indirectly. While many might think the boundary between time and space as quite distinct, the two dimensions can actually be considered intertwined. For example, when a student complains of the requirement of traveling to a local college campus to attend a class, seemingly a "space" demand, part of the complaint actually embeds the time required for the journey: the actual travel time, time spent searching for parking, and time spent walking to the classroom building. Thus, just as these two dimensions are mutually linked in the concept of a space-time continuum in high-level physics, these two attributes appear to be conjoined in the everyday world as well.

While the official reasons for wanting to transform courses were largely administrative and financial, students and instructors generally hold other motivations for being involved with distance education, particularly those associated with convenience in space-time. As mentioned above, older students, or those married with families, often need flexibility while scheduling classes. In fact, without the option of controlling their course scheduling requirements, they may not be able to take part in degree programs. But the issues of space-time relating to distance education go beyond simply whether a student can attend a class at a given time. In addition to simply "showing up," students have always had to complete homework, exercises, and class projects; participate in class discussions; and communicate with the instructor and with other students. Most (if not all) of these items will still have to be successfully navigated in a distance education environment and will be complicated by the constraints of the new medium.

Instructors may have an even more demanding reliance and dependence on space-time issues than do the students. As reported earlier, instructors in Drs. Wolf and Summerville's department must travel frequently, often disrupting their teaching schedules. When Dr. Summerville heard about the amount of time Dr. Gwendolyn spent in reading student communications, he considered the continuous servicing of the online site a form of "electronic tether." This seemed quite ironic since one of his main reasons for exploring distance education courses was the opportunity of breaking the tether of the physical space of the classroom. ("As long as I've got an IP connection, I've got a classroom.") Would distance education simply substitute the time tether for the space tether rather than eliminating the tether concept altogether?

The issues surrounding the novelty of distance education, for both student and instructor, demonstrated enormous complexity. Pedagogical matters on how time and space affected the course, on what "interacting" means in a distance education environment, and the new varieties of limitations and constraints imposed by distance education must be considered by future distance education instructors.

Preparing Students for Distance Education

While this research project specifically focused on what types of preparations an instructor might need to take into account in transforming a class, the needs of the student must also be taken into account for any distance education course to be considered successful. Dr. Gwendolyn often referred to the idea that first-time distance education students were "learning how to be different types of learners." Dr. Wolf also commented on how he had lost sight of the students' sense of being novices with taking distance education courses during part of his preparations and implementations for some classes.

While the idea of preparing some type of primer or manual for novice distance education students surfaced on a number of occasions, Dr. Wolf's team did not prepare or distribute such a manual for the students before the course began. The purpose of such a document would be to alert the students to some of the differences in taking a distance education course versus traditional course, This oversight did not emerge as an issue during the "postmortem" interviews after the course ended, and it only occurred to me during the write-up phase of the research that there were plans for such a document.

Departments, colleges, or universities desiring to expand their traditional base of students and enter into the world of distance education might consider publishing and making such documents readily available, even before the class begins. As one example, Pennsylvania State University's online program offers online tutorials and suggestions for students to determine if they might be could candidates for distance education courses as well as ways to prepare for online instruction. Students would perform better if explicitly told of the different nature of the demands placed on them in these new environments, and it would help any instructors considering such course transformations, as well.

The new and different learning styles required of students taking distance education courses might be thought of, in some manner, as different ways of conceptualizing and managing time. Dr. Gwendolyn pointed out that people in our culture possess an almost innate understanding of what it means to "go to school" in the sense of knowing the requirements of physically going to the campus, attending class, taking notes, studying for and taking exams, etc. As with all novel ideas, concepts involved in taking a distance education course will have to become learned, and this must occur over time. Many of these concepts involve time, for example, remembering to turn on the computer at a certain time (for a synchronous session); remembering to regularly check the web site for any changes, corrections, or updates; remembering to regularly post to bulletin boards; etc.

Limitations and Constraints in Distance Education Environments

To many educators, distance education offers unparalleled freedom of choices, with untapped or previously unavailable populations of students taking their courses whenever their schedules allow. However, in preparing this particular course for teaching at-a-distance, the opposite situation, problems of constraints and limitations, often arose. The first set of constraints arose because the course was being taught in the summer-shortened semester. Instead of the more luxurious 16-week term, which might have allowed for a more gradual roll-out of the online course, Dr. Wolf was faced with an 8-week course that immediately required his students to double up on their weekly lectures and quickly adapt to the new learning medium. The shortened semester also presented difficulties in setting up the chat room sessions and forced Dr. Wolf to hold both sessions on the same day. While undertaking a course transformation would be considered trying under even benign circumstances, the difficulties in scheduling, planning, and preparing a course syllabus were magnified by the limited time available in a shortened semester. Simply doubling the course meeting time in a semester half the usual length can never guarantee results equal to that of a normal semester. For example, some courses with large reading requirements may not afford the students ample opportunity to reflect over what they have read. The extra weeks of a semester might be critical for true understanding of the materials presented.

Dr. Gwendolyn spoke of the time requirement needed for people to adjust to the new expectations and procedures in distance education courses, for both students and instructors. In this case, a full semester might have also given the students more time to adjust to the new learning methods and techniques required in distance education environments. If they had been more comfortable in their new environment, they might have been more generous in their course evaluations.

Even within the structure of a longer term, the freedom promised by distance education must not be regarded as a panacea for all circumstances. Dr. Gwendolyn recounted an interaction with a student who had been commenting that he took the distance education course because he thought it would be the best choice to accommodate to his heavy business travel schedule. Instead he ended up with a course that required a great deal of student input on a regular basis. He thought it was the most restrictive class he had ever taken rather than the most liberating. Perhaps if he had taken the same distance education course offered by another professor, he would have been able to travel on business and complete the course without as much difficulty.

As the number and availability of distance education courses increase in the future, the full range of offerings might one day rival those available with traditional classes. Perhaps the description of a particular distance education course might include the type of information that would have aided the student in the example above and that type of unexpected difficulty might be avoided.

Other constraints revolved around the discussion of technological access to the Internet. Drs. Wolf and Summerville wanted to include some types of video clip formats for their course, but using video required high-speed Internet access, which was not available to most students. They had to make certain that any features incorporated into their web pages could accommodate the lowest common denominator of access, which amounted to using a modem set at 30 kps (kilobytes per second). Using such a slow value of 30 kps as a general standard might surprise some readers, since the vast majority of people have access to 56 kps modems. A number of smaller calling areas, however, still limit access to 28.8 kps, and 30 kps was taken as an average. As forms of high-speed access become more readily available, this constraint will be lifted.

Relevance of Andragogy and Change Theory in Distance Education

Early in the research process, I proposed that Malcolm Knowles's (1977, 1980, 1984) theory of andragogy might provide the most reasonable theory to frame this case study research. Dr. Wolf, based on this distance education class experience and with those of past classes, confirmed the majority of Knowles's description of the adult learner. Knowles's last assumption concerns motivation for learning, and in this case, Dr. Wolf's students did not adhere strictly to an adragological framework. Knowles presumed that internal motivational forces of self-esteem, self-actualization, and recognition would provide greater incentives than the external motivators of job success and financial reward. This might reflect Knowles's work environment while he was developing his theories, in that he was in largely involved with what would be called today "continuing education." For the course involved in this research, while internal motivators played an active role, most of the students were driven by external, career factors.

While Knowles's theory of andragogy may not be the best available theory to study and investigate distance education, another possible candidate might exist: change theory. In his 1999 address at Northwestern State University of Louisiana, Fuller addressed the need for considering a new cultural transformation and reeducation of adherents for distance education to succeed (Fuller, 1999). Relying on two notable historians of science, Thomas Kuhn and Kurt Lewin, Fuller proposed ideas for effecting systemic change in educational institutions noted for gradualism and continuous change.

Fuller believed that the role of technology had less to do with the curriculum of a subject taught online than did the actual underlying culture that taught online. He did, however, acknowledge the new role technology played between "instructor and instruction," and realized the differences among all participants in the new era of distance education, including trust between instructors and administrators:

> The commitment to distance education, as a new paradigm of instruction, requires a commitment to understanding the rules of instruction differently within the new dispensation. It requires commitment on the part of the faculty and institution, and implies a willingness to reveal much—perhaps to risk much—on the part of the faculty members participating in the project. (p. 5)

Reigeluth and Garfinkle (1994) also addressed the issue of systemic change within educational systems. They stressed the needs for seeking out new ways of thinking in battling the problems facing education. They also voiced concern over the intricacy that incorporating systemic thinking involves:

> Systemic thinking is also difficult. It requires keeping many aspects of the problem set in your head at one time. It is a community activity, not an individual one, with all the requisite challenges of any group task. Like design, system thinking demands persistence, because to think systemically means to constantly reflect back to previous assumptions, and to be flexible enough to change thinking that has been agreed upon previously. (p. v)

Flexibility appears to be a common theme among all researchers. Fuller embraced Lewin's theory of reeducation in the sense that basic human behaviors must change, and these changes cannot be gradual, whether in learning or training settings. For Lewin, reeducation involves a three step pattern by which old behaviors "unfreeze," change occurs, and the new behaviors "refreeze." This can only occur in a safe environment.

Dr. Wolf's experiences allude to the required safe environment for novice distance education instructors. In some sense, he trusted the departmental administrators to make allowances for his first venture into teaching at-a-distance. While he did not specifically mention how the department responded to his lower student evaluations, his decision to opt out of teaching future distance education courses appear to indicate they did not immediately allay his fears about how those evaluations might affect his position within the department.

While the changes between student and instructor may be the most obvious, perhaps more important are the changes required between the instructors and the administration (or institution, as Fuller wrote). Fuller concludes his speech with the following challenge:

Distance education requires a thoroughgoing change in the classroom and the campus. In some ways, the computers are the least of the revolution. The fundamental relationship among professor, the learner, and the institutions of higher learning are all on the line today. New models of classroom instruction are everywhere. It's time to test new ways that scholars can prepare themselves—to prepare each other and their institutions—to thrive in the new world. (p. 11)

Concluding Remarks

This study presented the experiences of one group of instructors as they transformed a traditional, face-to-face course to an Internet-based, distance education course. I tried to present as detailed and "thick" a description of the process as possible so that others interested in the prospect of transforming their own courses might understand the process as completely as possible. In the process, I uncovered a number of themes and concepts that I believe transcend the issues of this single case study and would be relevant to all distance education instructors.

By its very nature, distance education distorts and amplifies differences in the concepts of time and space. Nearly all of the key themes and concepts examined during this research reflected relationships of how people either reacted to or planned to account for variations in these two dimensions when compared to traditional, lecture-based education. Attending class; communicating, both in class as well as outside of class; compensating for the loss of verbal and nonverbal cues and body language; and the general issues relating to constraints and limitations within the confines of distance education can be attributed to these key concepts.

At the outset of this undertaking, I originally thought that Knowles's theory of andragogy would be the most suitable theoretical framework to support this research. I now do not believe this original assessment to be accurate. I think an investigation of change theory as applied in educational environments might be a much better framework for understanding the different processes that concurrently take place at the time of transition from traditional modes of instruction to distance educational practices.

All educators should be aware of the changes taking place in distance education, if not for their immediate teaching efforts, then for the necessity of observing the changes affecting their communities. A case study, no matter how thorough, can never hope to capture the ultimate answer of any research question—it can only hope to accurately portray what occurred in this one instance. I hope that this research effort will motivate and inform other novice instructors interested in using distance education in their teaching efforts. Additional research into the discovery of the best methods for transforming and adapting to this new environment must be forthcoming among all stakeholders in higher education.

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Scaffolding Students' Problem-Solving Processes on an Ill-Structured Task Using Question Prompts and Peer Interactions

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Abstract

This study examines the use of question prompts and peer interactions as scaffolding strategies to help undergraduate students with their problem-solving processes on an ill-structured task. The mixed research method, combining both experimental and comparative multiple-case studies, were used to study the outcomes as well as the processes of students' problem-solving activities in terms of problem representation, developing solutions, constructing argumentation, and monitoring and evaluation. The result of the experimental study showed that the students working with peers and also receiving question prompts (PQ) significantly outperformed the other treatment groups, that is, individuals with question prompts (IQ), individuals without question prompts (IC), and peers without question prompts (PC). At the same time, though the students in the IQ group did less well than the PQ group in the process of problem representation, they significantly outperformed the PC and the IC groups in the processes of problem representation, justifications, and monitoring and evaluation. There were no significant differences between the PC and the IC groups in any of the four problem-solving processes. It appeared that question prompts were a superior scaffolding strategy over peer interactions in supporting students' ill-structured problem-solving processes. However, the comparative, multiple case studies revealed the complexity of the peer interaction context and the relationship between question prompts and peer interactions. While this study confirms previous findings on the effectiveness of question prompts in facilitating students' cognition and metacognition, it also indicates the benefits of peer interactions, which were contingent upon group members' active and productive engagement, that is, questioning, explaining, elaborating and providing feedback among peers. The study implies that, in order for students to gain full benefits from peer interactions, the peer interaction process itself need to be scaffolded, especially when students were novice problem solvers; and question prompts, through expert modeling, may serve to facilitate this process.

Problem Statement

Complex, real-world problem solving is an essential component of learning. Based on previous research (e. g., Bransford, Brown, & Cocking, 2000; Bransford & Stein, 1993; Jonassen, 1997), engaging students in complex, ill-structured problem-solving tasks not only helps them to apply knowledge in real-world situations, but also to facilitate knowledge transfer. However, previous research has also pointed to students' deficiencies in problem-solving skills, for instance, failing to apply knowledge learned in one context to another, especially when solving problems on ill-structured tasks (Gick and Holyoak, 1980; Gick, 1986). While students' difficulties in problem solving are partly attributed to misconceptions or shallow conceptions of domain knowledge (P. J. Feltovich, Spiro, Coulson, & J. Feltovich, 1996), they are, to a greater extent, due to a lack of metacognitive knowledge (Brown, 1987).

Therefore, it follows that supports should be provided to students during problem solving in cognition and metacognition through various scaffolding strategies, such as coaching through prompts (Scardamalia, Bereiter, & Steinbach, 1984; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Schoenfeld, 1985; King, 1992), modeling through reciprocal teaching or peer-regulated learning (e.g., Palincsar & Brown, 1984; Palincsar, Brown, & Martin, 1987), and guiding students to self-generate questions (King, 1991). These strategies were found to be effective in fostering comprehension, monitoring cognitive thinking, facilitating general problem solving (e.g., Palincsar & Brown, 1984; Scardamalia et al., 1989), and supporting reflective thinking (Lin, Hmelo, Kinzer, & Secules, 1999).

Purpose of the Study

The purpose of the study was to investigate the effects of question prompts and peer interactions in scaffolding undergraduate students' problem-solving processes on an ill-structured task. Although these two strategies had been studied in previous research, few studies had been conducted on their use to support students' ill-structured problem solving. Hence, this study was focused on the effects of question prompts and peer interactions in scaffolding students' problem-solving processes on an ill-structured task, especially in *problem representation, solution, justifications*, and *monitoring and evaluation*, which characterize the major processes of ill-structured problem solving according to previous research (e.g., Sinnott, 1989; Voss, 1988; Voss and Post, 1988). It is hoped that the findings of this research can be applied in computer-based and web-based instructional design, in the context of both distance education and classroom instruction.

This study specifically addressed the following questions:

Question 1. Does the use of question prompts have an effect on students' problem solving on an ill-structured task in problem representation, solution development, justification, and monitoring and evaluation of solutions?

Question 2. Does the use of peer interaction have an effect on students' problem solving on an ill-structured task in problem representation solution development, justification, and monitoring and evaluation of solutions?

Question 3. Does the use of question prompts combined with peer interaction have an effect on students' problem solving on an ill-structured task in problem representation, solution development, justification, and monitoring and evaluation of solutions?

Question 4. How does the use of question prompts influence students' cognition and metacognition in the process of developing solutions to ill-structured problems?

Question 5. How does the use of peer interactions influence students' cognition and metacognition in the process of developing solutions to ill-structured problems?

Operational Definitions

In this study, *question prompts* refer to a set of static questions, both content-specific and metacognitive types, which were generated by the content domain experts and were designed to facilitate cognition and metacognition and guide students through problem-solving processes. They were related to a problem-solving task which students were engaged in. For example, "What are the parts of the problem?" was intended to provide cues to students, activate their prior-knowledge, and lead them to represent the problem. When prompted to reflect on their solutions, students were asked "How do I justify this specific system design? If I develop a web-based solution, for example, can I explain why I took that approach?" The question prompts were delivered through the web, which students had access to while working in a computer laboratory.

Peer interactions are defined as verbal interactions of students working together in small groups of three or four to engage in a task of ill-structured problem solving. Students were expected to engage in a problem-solving task, actively interact with each other to negotiate meanings, to help each other construct meanings, and collaboratively develop solutions to a problem. Although they may have different abilities, skills and background experiences, they were not assigned specific roles.

Method

Participants

115 undergraduate students were recruited from three class sections of an introductory course in Information Sciences and Technology (IST) at a major university in the United States to participate in the experimental study, and 19 of them also participated in the comparative, multiple-case studies. The course was designed not only to introduce basic concepts and provide an overview of information sciences and technology, but also to incorporate collaborative learning and problem-solving experiences. It consisted of two lectures and one laboratory session each week. The 75-minute lecture session was held by a professor. The 115-minute laboratory session was conducted by a teaching assistant. The primary purpose of the lab was to provide hands-on experience in information sciences and technology and develop technology skills as well as problem-solving and collaboration skills. There were two teaching assistants attached to the three class sections, with the principal investigator being one of them. All the three class sections shared a common curriculum and a core textbook, and the three professors and the two teaching assistants were considered equivalent in terms of their expertise and teaching experience. Due to the relative large size of the class (about 50 students in each class section), the class web site was used as a supplementary delivery medium to foster classroom instruction and monitor laboratory activities. The students were often required to work in teams to complete a course project or laboratory tasks.

Design

A mixed study design, combining an experimental study with comparative, multiple-case studies, was applied. According to Greene, Caracelli, and Graham (1989), mixed study methods help a researcher to seek triangulation of the results from different data sources, examine overlapping and different facets of a phenomenon, discover paradoxes, contradictions, and fresh perspectives, and expand the scope and breadth of a study. The experimental study, designed to answer research questions 1-3, was conducted to measure the students' problem-solving *outcomes* on an ill-structured task in the four problem-solving processes: *problem representation*, *solutions*, *justifications*, and *monitoring and evaluation*, and in four different treatment conditions: individuals with question prompts (IQ), individuals without question prompts (IC), peers with question prompts (PQ), and peers without question prompts (PC). The comparative, multiple-case studies, through observation, interviews, and think-aloud protocols, were carried out to gain insights into students' problem-solving *processes*, especially their cognition and metacognition, as influenced by question prompts or peer interactions. The case studies were expected to seek explanations to research questions 4-5.

The Quasi-Experimental Study

As the experimental study was integrated into the curriculum and carried out in a natural classroom setting, the participants were assigned to different treatment groups as intact groups. From Questions 1-3 the following hypotheses were generated:

1. Students working individually and also receiving question prompts will demonstrate better problem-solving skills on an ill-structured task than their counterparts who did not receive the question prompts in (a) problem representation, (b) developing solutions, (c) making justifications and (d) monitoring and evaluating solutions.

2. Students working with peers, with or without question prompts, will demonstrate better problem-solving skills on an ill-structured task than students working individually, with or without question prompts, in (a) problem representation, (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions.
3. Students working with peers but also receiving question prompts will demonstrate better problem-solving skills on an ill-structured task than all the other treatment groups (PC, IQ, and IC) in (a) problem representation, (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions.

The participants of the four different conditions were given the same task to solve during a 115-minute laboratory session. The task presented an authentic scenario (Table 1) concerning the content domain of IST, which required students to develop a solution report to the problem presented.

Table 1. The ill-structured problem-solving task

> *Many customers complain that they have difficulty finding items in a large store. This problem especially affects college students, who often have very little time for shopping. Since students are major customers in this small college town, the manager of a local major store has hired you (or your team) as a consultant to propose IT-based solutions to the problem. Your task is to make suggestions about the features to be included in a new information system. As part of this, you are to develop a simple model illustrating your proposed system. Based on the findings of a survey, the proposed information system should be able to help customers find items quickly, to present an overall view of all the items on a shelf and an aisle, and to map out the shortest route for getting all the items a customer needs to purchase. There may be some other important factors you may need to consider.*

The participants who were assigned to the Question-Prompt conditions (PQ and IQ) received question prompts at the same time as they received the problem-solving task. The question prompts consisted of 10 question prompts categorized into four types of prompts:

a) Problem Representation Prompts: *What is the problem?*
b) Problem Solution Prompts: *How do I solve the problem?*
c) Justification Prompts: *What are the reasons for…?*
d) Monitoring and Evaluation Prompts: *Am I on the right track?*

There are a number of questions in each category of question prompts, as illustrated in Table 2:

Table 2 The justification prompts

> *What are the reasons for my proposed solution?*
>
> - *How would I justify this specific system design. For example, if I develop a web-based solution, can I explain why I took that approach?*
> - *Do I have evidence to support my solution (i.e., the specific IT system I have proposed)? What is the chain of my reasoning to support my solution?*

The problem-solving reports were evaluated based on a judgmental rubric system to measure the four problem-solving processes by the principal researcher and another two raters. The interrater consistency was reached to ensure the reliability of the evaluation. A multivariate analysis of variance (MANOVA) (Stevens, 1986) was employed to analyze the relationships between question prompts and the four problem-solving processes, and between peer interactions and the four problem-solving processes across the four different conditions. As the MANOVA result was statistically significant, the univariate (ANOVA) results were examined for each dependent variable. For the significant univariate results, post hoc comparisons were performed to identify where the differences resided.

The Comparative, Multiple-Case Studies

Eight cases were studied. Four individuals, with two from the IQ and two from the IC condition, were selected for think-aloud protocols, which were conducted when each of them was engaged in the problem-solving task. In addition, observations and interviews were conducted on four selected groups to gather data about their problem-solving processes, two groups from the PQ and two groups from the PC condition. The multiple cases were analyzed for the purpose of theoretical replication, which either (a) predicts similar results or (b) produces contrasting results but for predictable reasons (Yin, 1989).

Miles and Huberman's (1994) data analysis model, which involves three subprocesses--data reduction, data display and conclusion drawing and verification, was used to guide the qualitative data analysis. The data analysis primarily consisted of the following steps: reading and jotting marginal notes on the transcripts; identifying patterns and labeling concepts; organizing labeled concepts into a data display matrix, identifying themes and drawing conclusions. The focus of the analysis was on cross-case comparisons viewed from different dimensions: the four ill-structured problem-solving processes and the effects of question prompts and peer interactions on cognitive thinking and metacognitive skills.

Results

The Quantitative Results

The results of multivariate analysis of variance showed overall differences for the treatment effect and the four dependent variables of problem-solving processes. The MANOVA results were statistically significant ($F = 4.025$, $p < .001$). Further, the results of the univariate ANOVA tests indicated that there were significant statistical differences in all the four dependent variables, with an F ratio of 20.43, 8.27, 11.26 and 7.21 respectively ($p < .001$). Table 3 is a summary of post hoc Scheffe mean comparison. It shows several statistical mean differences among the four treatment conditions in the four dependent variables. Table 4 summarizes the descriptive statistics for the dependent variables by treatment groups. It displays means and standard deviations of different treatment groups by the four dependent variables. As each dependent variable has a different subtotal of scaled points, percentage was used to create a common basis for comparison of means among the four dependent variables.

Table 3 Summary of post hoc Scheffe comparison

Dependent Variable				
	Representing Problem	Developing Solutions	Making Justifications	Monitoring and Evaluation
Comparison Group	Mean Difference (%)	Mean Difference (%)	Mean Difference (%)	Mean Difference (%)
Peer Question (PQ) vs. Peer Control (PC)	**35.9*** (PQ > PC)	**20.3*** (PQ > PC)	**33.7*** (PQ > PC)	**35.6*** (PQ > PC)
Peer Question (PQ) vs. Individual Question (IQ)	**17.6*** (PQ > IQ)	11.8	7.7	1.5
Peer Question (PQ) vs. Individual Control (IC)	**39.8*** (PQ > IC)	**21.3*** (PQ > IC)	**27.3*** (PQ > IC)	**34.8*** (PQ > IC)
Peer Control (PC) vs. Individual Question (IQ)	**-18.3*** (PC < IQ)	-8.5	**-25.9*** (PC < IQ)	**-34.0*** (PC < IQ)
Peer Control (PC) vs. Individual Control (IC)	3.9	1.0	-6.3	-0.8
Individual Question (IQ) vs. Individual Control (IC)	**22.2*** (IQ > IC)	9.5	**19.6*** (IQ > IC)	**33.2*** (IQ > IC)

Note.

a) The mean difference shown in this table is the subtraction of the second condition (on the lower line) from the first condition for example, 35.9 (Mean Difference for Problem Representation) = PQ - PC.

b) Mean difference (%) is calculated using the values which appear in Table 4.

c) (%). The mean difference is converted into percentage in order to create a common basis for mean comparison, as the subtotals for the four dependent variables are different.

d) *. The mean difference is significant at the .05 level.

Table 4 Descriptive statistics for each dependent variable by treatment group

	Treatment Group							
	Peer Question (PQ) (N=13)		Peer Control (PC) (N=11)		Individual Question (IQ) (N=15)		Individual Control (IC) (N=16)	
Dependent Variables	Mean%	SD %	Mean %	SD %	Mean %	SD %	Mean %	SD %
Representing Problem	62.3	17.4	26.4	15.7	44.7	15.5	22.5	11.3
Developing Solutions	88.5	11.9	68.2	17.1	76.7	10.4	67.2	11.1
Making Justifications	79.1	18.1	45.5	12.5	71.4	17.1	51.8	18.7
Monitoring and Evaluation	61.5	31.1	25.9	24.6	60.0	30.2	26.8	22.7

As it can be seen from Table 3 and Table 4, The statistical results generally confirm *Hypothesis 1*, showing that students working individually and also receiving question prompts (IQ) demonstrated higher problem-solving skills on an ill-structured task than the individuals who did not receive the question prompts (IC) in (a) problem representation, (c) making justifications, and (d) monitoring and evaluating solutions. However, the IQ group did not perform significantly better than IC group in (b) developing solutions.

The statistical results only partially support *Hypothesis 2*. Students working with peers and also receiving question prompts (PQ) outperformed those working individually and without question prompts (IC) in all the four problem-solving processes. They also outperformed those working individually and also receiving question prompts (IQ) in (a) problem representation. However, no significant differences were found in any of the four problem-solving processes between the PC and IC groups. On the contrary, students working individually but receiving question prompts did significantly better than students working with peers but without question prompts in three processes: (a) problem representation, (c) making justifications, and (d) monitoring and evaluating solutions.

In testing *Hypothesis 3*, students working with peers and also receiving question prompts (PQ) demonstrated better problem-solving skills than the students in the other conditions (PC, IQ, and IC) in (a) problem representation. In (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions, students in the PQ condition did significantly better than those in the PC and the IC condition, though not than those in the IQ group.

The Qualitative Findings

The effect of question prompts. The cross-case qualitative analysis revealed that the question prompts supported students' cognition and metacognition through directing attention to their problem-solving processes, articulating thoughts, and providing guidelines. First, question prompts served as a "reminder" to direct the students' attention to some important information they might not have thought about. They helped students to represent the problem, make connections between different factors and constraints and link to the solutions. In addition, the question prompts also led the students to think about alternative solutions and the viability of their solutions. A group of students who failed to use the question prompts and thus failed to think about all the possibilities and alternative solutions indicated the important functions of question prompts. Second, it was observed that question prompts reminded the students to state their reasons and construct arguments for their proposed solutions. Third, students mentioned that the question prompts were useful to help them organize their thinking and break down the problem into small steps. Therefore, the question prompts may have served as expert modeling to support students' cognitive and metacognitive thinking by guiding problem representation, metacognition, and the justification process.

The effect of peer interactions. The comparative case studies indicated that the greatest advantages of peer interactions lie in building upon each other's ideas, questioning and providing feedback, providing multiple perspectives, and benefiting from distributed knowledge. Those attributes influenced students' cognitive thinking and metacognitive knowledge. It was observed in all the cases that when peers worked together, they typically started the problem-solving processes by brainstorming ideas, which were presented in the form of questions or suggestions, such as "How about…?" and "What do you think…?". Then, an initial idea got further developed. It was also observed that during peer interactions, students asked questions, offered suggestions, elaborated thinking and provided feedback. Thus, peer interactions created an opportunity to ask, clarify, explain, and elaborate. The great advantages of peer interactions, as the participants consistently pointed out in their interviews, were the multiple perspectives and different expertise different individuals brought to the problem-solving processes.

Discussion

Here is a summary of answers to research questions 1 – 5:

1. Question prompts had a significantly positive effect overall on students' problem-solving processes on an ill-structured task, specifically in (a) problem representation, (c) making justifications and (d) monitoring and evaluating solutions.
2. The use of peer interactions had a partially positive effect on students' problem solving processes on an ill-structured task in that, the students in the PQ condition significantly outperformed those in the IC condition in all the problem-solving processes and the IQ condition in problem representation; whereas the students in the PC condition did not perform significantly better than those in the IQ or the IC condition in any of the problem solving processes.
3. In comparison with the separate use of question prompts and of peer interactions, the combination of question prompts with peer interactions showed the greatest positive effect overall on students' problem-solving processes on an ill-structured task.
4. In the process of developing solutions to ill-structured problems, question prompts influenced students' cognition and metacognition by (a) directing attention, (b) articulating thoughts, and (c) providing guidelines for problem solving.
5. In the process of developing solutions to ill-structured problems, peer interactions influenced students' cognition and metacognition by (a) building upon each other's ideas, (b) questioning and providing feedback, (c) providing multiple perspectives and (d) distributing cognition.

The result of the experimental study showed that the students working with peers and question prompts (PQ) significantly outperformed the other treatment groups, especially the students without question prompts (either working individually or with peers), in all the four problem-solving processes. At the same time, the students working individually and with question prompts, though they did less well than the PQ group in problem representation, significantly outperformed the PC and IC groups in problem representation, justifications, and monitoring and evaluation. There were no significant differences between the PC and the IC groups in any of the four problem-solving processes. It appeared that question prompts were a superior scaffolding strategy over peer interactions in supporting students' problem solving on an ill-structured task. However, the comparative, multiple case studies revealed the complexity of the peer interaction context and the relationship between question prompts and peer interactions. While this study confirmed the findings of previous research on the effectiveness of question prompts in facilitating students' cognition and metacognition, it also showed the benefits of peer interactions, which were contingent upon group members' active and productive engagement in peer interactions, that is, questioning, explaining, elaborating and providing feedback among peers. The findings supported Webb's (1989) research on the learning conditions for group collaboration.

The study implies that, in order for students to gain full benefits from peer interactions, the peer interaction process itself need to be scaffolded, especially when students were novice learners in problem solving; and question prompts, through expert modeling, may serve to facilitate this process. Further research is suggested to examine the transfer effect of question prompts on students' self-generated questions if students are provided with similar question prompts over a period of time and if their improved skills in self-generated questions during problem solving will facilitate them to solve an ill-structured problem. More research efforts are also needed to examine group dynamics when investigating the role of peer interactions in scaffolding ill-structured problem solving. Group dynamics involve many aspects, including peer learning approaches, peer interaction patterns, students' perception and motivation about peer learning, any of which may have an impact on students' problem-solving performance.

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Using a Video Split-Screen Technique to Evaluate Streaming Instructional Videos

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Abstract

The Media Center at Eastern Illinois University developed and streamed on the Internet 26 short (1-5 minutes) instructional videos about WebCT that illustrated specific functions, including logging-in, changing a password, and using chat. This study observed trainees using and reacting to selections of these videos. It set out to assess attitudes toward the quality of online videos and to identify perceptions trainees had about the video's impact on their learning. A secondary aim of the study was to evaluate the potential of a video-split-screen technique for making observations of trainees during training.

Trainees responded positively to the video training and the mode of delivery. They also perceived their learning to have been positively impacted as a result of it. As an observation tool, the video-split-screen technique was useful and it yielded much data in multiple media formats.

Instructional video training as presented in this paper appears to be a viable WebCT resource. An extensive development effort was not needed to produce a worthwhile product that is easily modified and updated. These facts coupled with trainees' positive reactions suggest that this instructional modality can be an effective supplement to face-to-face training.

Introduction

In 1997, the Media Center at Eastern Illinois University embarked on a technology training initiative aimed at improving faculty members' ability to effectively and appropriately utilize and integrate computer technology into the teaching and learning process. To foster faculty members' willingness to invest in using technology , the initiative provided services in three key areas. First, technical support services addressed software and hardware problems. For instance, an instructor having difficulty with HTML coding or a specific software application could call the Center for assistance. Second, the Center developed courseware applications as well as materials to support classes, including Web sites and CD-ROM materials. Third, the Center offered a number of faculty development activities, such as hands-on training workshops, informational sessions/demonstrations, and computer-based tutorials. In this paper, the authors limit the discussion of the initiative to the area of faculty (technology) development.

Subsequent to the implementation of the initiative the University adopted WebCT as its Web-based course development platform. WebCT is a development tool that enables instructors to create and distribute on-line class materials, or entire online courses. The University administration charged the Media Center with formulating a WebCT training program, as part of it existing training initiative. The program was to introduce the software to faculty and teach them how to use it for instructional and learning purposes.

The Center's staff delivered WebCT training primarily through face-to-face workshops that were 2-3 hours in length. Throughout each academic semester, they offered over 40 workshops on the following topics:

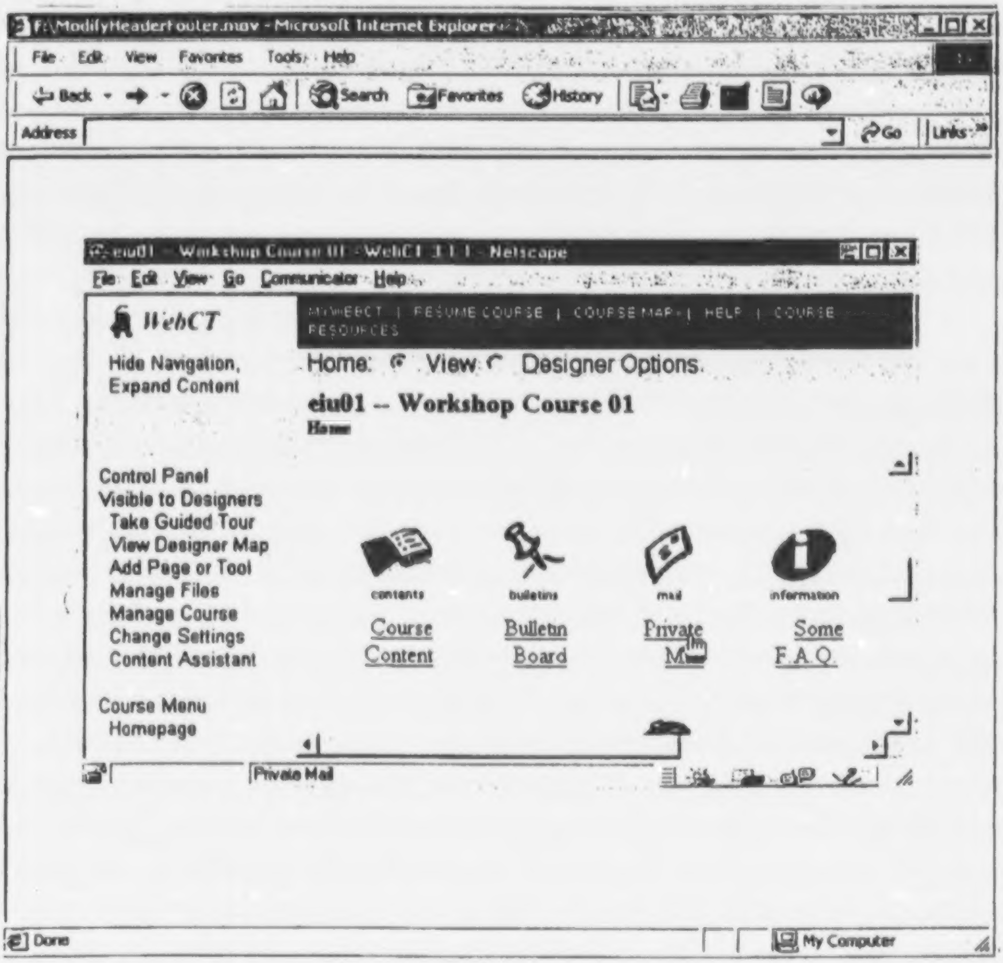
- WebCT basics: An Introduction to WebCT
- Using WebCT Communication Tools
- Using WebCT Quiz Modules
- Using WebCT Student Management
- Using WebCT File Manager, Course Content, Calendar

Several open sessions were also offered in which the staff presented no formal instruction but assisted faculty with developing content in WebCT.

Streaming Training Content

While the WebCT trainers successfully offered numerous workshops at varying times throughout the semester to accommodate faculty schedules, they observed three shortcomings with the workshop approach. First, despite the availability of sessions, class scheduling conflicts prevented some faculty from attending. Second, faculty indicated that the timing of the workshops did not coincide with the time they allocated for development. For example, one individual commented that while he attended a workshop in October, he was unable to do any WebCT development until the end of the semester, at which time, he thought his familiarity with the program would wane. Third, in many ways, the workshops did not support individual work habits or needs. Trainers offered all sessions during normal work hours and training was general in nature so that it accommodated the greatest number of participants. As a result, an individual working outside normal business hours could not call on the expertise of a trainer and was therefore left to his/her own resources to solve a problem. Moreover, individuals with specific WebCT needs or questions were difficult to accommodate during workshops, and the trainers observed that many of these unique needs were unmet.

The aforementioned issues associated with the workshop format prompted the Media Center staff to explore alternative training delivery modalities, one of which being streaming video training. Two staff instructional technologists developed 26 short (1-5 minutes) instructional videos about WebCT that illustrated specific functions, including logging-in, changing a password, and using chat. While the videos were general to WebCT, they contained information specific to Eastern Illinois University, such as how to access a WebCT course from the university home page or how to obtain a WebCT account. The technologists used a screen capturing utility (SnagIt) to record the WebCT screens, and they narrated while performing program functions (see Figure 1).


F:\ModifyHeaderFooter.mov - Microsoft Internet Explorer
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eiu01 -- Workshop Course 01 - WebCT 3.1.1 - Netscape
File Edit View Go Communicator Help
WebCT
MYWEBCT | RESUME COURSE | COURSE MAP | HELP | COURSE RESOURCES
Hide Navigation, Expand Content
Home: View Designer Options
eiu01 -- Workshop Course 01
Home
Control Panel
Visible to Designers
Take Guided Tour
View Designer Map
Add Page or Tool
Manage Files
Manage Course
Change Settings
Content Assistant
Course Menu
Homepage
contents
bulletins
mail
information
Course Content
Bulletin Board
Private Mail
Some F.A.Q.
Private Mail
Done
My Computer

Figure 1. WebCT Video Played in a Web Browser

The approach did not require many hours of development, an important criterion of the technologists. Time constraints prohibited these individuals from spending exceedingly long periods of time developing the videos. Moreover, the changing nature of the WebCT software with updated versions, etc. necessitated a short development cycle.

Developing the WebCT Training Videos

As mentioned, the instructional technologists used the SnagIt software utility to capture computer video screens and audio narration simultaneously. The program records the video and audio into a single Avi file, which is commonly used in Windows-based PC's.

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The recordings produced large file sizes that could not be streamed on the Internet and so the Avi files were converted to a QuickTime format. QuickTime was chosen because the Media Center owned a QuickTime streaming server. The accepted industry standard for converting audio and video files with the least possible quality loss (or generation loss) is Terran Corporation's Media Cleaner Pro. Version 5 of the software is called Cleaner. Cleaner and QuickTime Pro both encode miscellaneous QuickTime and streaming QuickTime files with constant bit-rate encoding using several different types of compression schemes.

Compressing video causes the video to shrink in size. Instead of encoding each frame of video with the entire contents of that frame, only the changes from frame to frame are encoded. In addition, if colors in an area of the video are similar, a single byte of information representing the entire area is used resulting in smaller file size. Smaller video files and lower data rates enable the video to be streamed more easily over the Internet and to be viewed on dated computers.

The Media Center also purchased a plug-in for Media Cleaner Pro called Sorenson Developer edition. In order to encode a QuickTime movie with variable bit-rate encoding the plug-in is required. Variable bit-rate encoding allows the bit-rate to vary as the file requires bytes resulting in higher quality video at a low average bit-rate. Constant bit-rate provides predictable data rates, but produces video of poorer quality.

Typically, the largest video frame size that can be streamed over the Internet or a very fast connection (e.g., T-1 or faster) is 320 X 240 with 10 frames per-second. Since the size of the WebCT videos was approximately 640 X 400, a compromise was achieved by decreasing the frame rate. To obtain the same data rate, one can increase frame size while decreasing frame rate or vice versa. Since the motion on the screen was mainly mouse movement and Web page scrolling, the file frame rate was decreased to 4 frames per-second.

After the files were processed by Cleaner 5, they were copied to the QuickTime server. The developers used a program called Make Reference Movie to create small QuickTime files (approximately 4K) that were placed on the university's web server along with HTML documents that linked to the videos.

Purpose

In the researchers' view, delivering the videos in a Web-based hypermedia environment was unique, and it presented a number of issues that needed careful examination. As a result, they set out to examine how trainees would use and react to the instructional videos. Specifically, the researchers set out to:

1. assess trainees' attitudes about the quality of the online instructional videos used in the project and the method by which they were delivered;
2. identify trainees' perceptions about the effectiveness of the videos to fostering their learning.

A secondary aim of the study was to evaluate the potential of a video split-screen technique for observing the processes (e.g., performance tasks/work behaviors) trainees engage in while using the instructional videos.

Method

Hypermedia, characterized by an arrangement of nodes and links, provides non-sequential access to mediated content (Kumar, Helgeson & White, 1994). These informationally rich and flexible user-centered designs add complexity to the study of how users interact with a system (Gay & Mazur, 1993). Some evaluation approaches promote a holistic orientation (Winograd & Flores, 1986) using qualitative methods (Card, Moran & Newell, 1983) and multiple data collection instruments (Marchionini, 1990). Instruments for monitoring human-computer interactions often allow for the compilation of data in visual (video, photographic), textual, and auditory form.

In accordance with a more qualitative approach to evaluation, the researchers used a video-split-screen recording technique to monitor how trainees used the instructional videos. A video camera recorded trainees as they used the software. Simultaneously, a scan converter converted the computer screen output to a video/NTSC signal. Both signals (trainee and computer screen) were sent to a video effects generator and combined into one image, which allowed the researchers to observe the computer screen, including mouse movements, object (e.g., buttons, links, etc.) selections, and web page changes simultaneously with trainees' behavior (see Figure 2).

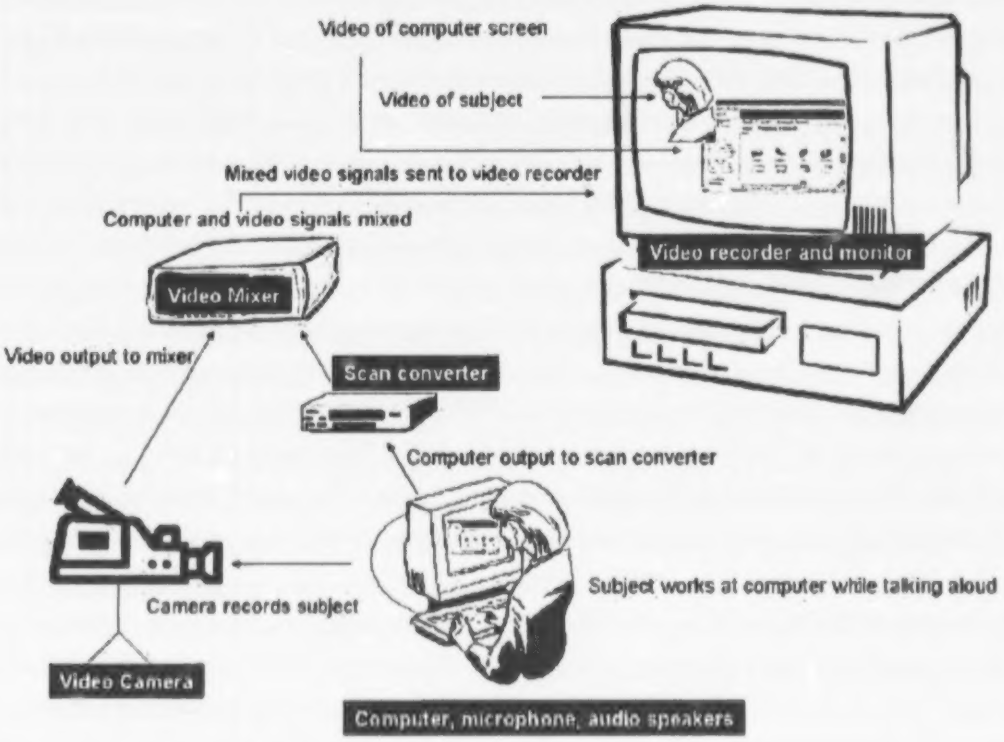
Video of computer screen
Video of subject
Mixed video signals sent to video recorder
Computer and video signals mixed
Video Mixer
Video recorder and monitor
Video output to mixer
Scan converter
Computer output to scan converter
Subject works at computer while talking aloud
Camera records subject
Video Camera
Computer, microphone, audio speakers

Figure 2. Video Split-screen Recording Process

Materials

The researchers created a web site that provided an overview of the study and instructions for completing it. They chose 11 of the 26 instructional videos for review because the selected videos represented fundamental WebCT components. Video topics included:

- Logging into WebCT
- Modifying headers and footers
- Communication Tools Overview Part 1
- Communication Tools Overview Part 2
- WebCT Mail Overview
- Sending Mail through WebCT
- Using Bulletin Boards Part 1
- Using Bulletin Boards Part 2
- Using Bulletin Boards Part 3
- Starting Chat
- Using Chat

Prior to beginning the study, trainees completed a pre-usability survey that assessed their familiarity with various WebCT components. Trainees rated their familiarity on a 7-point scale from 1 (Completely Unfamiliar) to 7 (Very Familiar). They viewed each of the 11 videos, in any order of preference. After viewing each video, trainees practiced the WebCT function or component they just viewed. When practicing, the researchers asked them to think aloud or verbalize what was going through their minds. After practicing, trainees completed a short WebCT Function survey, which presented 7 attitudinal statements to be rated from 1 (Strongly Disagree) to 7 (Strongly Agree). Once trainees watched all 11 videos, practiced them, and completed their

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respective function surveys, they received a post-usability survey that presented identical questions to those of the pre-usability survey. It took each trainee approximately two hours to complete the study.

The five trainees who completed all evaluation tasks were undergraduate students employed at the Media Center. Most indicated that they were computer familiar but had little or no experience with WebCT.

Results

Table 1 shows how familiar the trainees were of the WebCT components before and after the video training. The higher the average rating, the more familiar the trainees were with the specific component (the scale ranges from 1 to 7). Separate t-tests for dependent or paired means were conducted for each WebCT component. At a significance level of .05, results indicate that the trainees became significantly more familiar with the components after the video training. Table 1 also shows that the trainees were slightly familiar with the WebCT in general and with logging into the WebCT before the training, but were completely unfamiliar with the specific WebCT components.

WebCT Component	Before Video Training	After Video Training
WebCT in general	2.60	5.60
Logging into WebCT	3.60	6.80
Changing WebCT password	1.80	5.20
Modifying header/footer on the WebCT homepage	1.40	7.00
Reading a message in a WebCT discussion forum	1.40	5.80
Posting a message to a WebCT discussion forum	1.40	5.80
Reading a message with WebCT email	1.40	6.40
Posting a message with WebCT email	1.40	6.40
Accessing WebCT chat rooms	1.40	6.40
Using WebCT chat rooms	1.40	6.40

Table 1. Familiarity with WebCT's Components Before and After the Video Training

The trainees' evaluations of the eleven videos were averaged per evaluation item and are shown in Table 2 below. For each item, the trainees gave very positive evaluations of the videos. The higher the average rating, the more positive the evaluation (on a scale of 1 to 7).

Evaluation Item	Average Rating
No problems accessing the video	6.76
No problems using and viewing the video	5.95
The video was easy to understand	6.33
The video was well-paced	6.44
The video helped in learning about the specific WebCT function	6.59
The video format was the best way of learning about the specific WebCT function	6.62
Would recommend that others use the specific video	6.40

Table 2. Trainees' Evaluations Across the Training Videos

The trainees' evaluations of each instructional video were obtained by averaging their ratings across the seven evaluation items. The average ratings per video are shown in Table 3 below. The trainees gave very positive evaluations for each video. The higher the average rating, the more positive the evaluation (on a scale of 1 to 7).

Training Video Title	Average Rating
Logging into WebCT	6.11
Modifying headers and footers	6.17
Communication tools overview (part 1)	6.29
Communication tools overview (part 2)	6.54
WebCT mail overview	6.69
Sending mail through WebCT	6.69
Using bulletin boards (part 1)	6.37
Using bulletin boards (part 2)	6.57
Using bulletin boards (part 3)	6.40
Starting chat	6.51
Using chat	6.49

Table 3. Trainees' Evaluations of the Specific Training Videos

Trainees Commentary

Overall, trainees had few general comments about the videos. Two individuals wrote the following comments on the pre-usability survey:

- *I did a little with WebCT questions over in the Media Center.*
- *I don't know anything about WebCT so it will be nice to learn.*

The same two individuals wrote the following comments on the post-usability survey:

- *I don't feel I learned much.*
- *This was fairly easy to understand. Because the video was sometimes fuzzy it was hard to see everything that was going on. I feel like I have a good grasp of the beginnings of WebCT and could probably figure out more things on my own.*

It is difficult to ascertain whether the trainee who wrote, *I did not learn much*, was commenting about the inability of the video training to facilitate learning about WebCT or that her learning did not increase because her skills equaled the level of mastery the videos sought to promote. Her ratings of post-usability survey items were high ($\underline{M} = 6.4$) compared to her pre-usability survey ratings ($\underline{M} = 1.7$), which suggests that she perceived her learning to have increased.

Trainees made 15 independent comments about the videos (see Table 4). Generally, the commentary reflected their concerns about the video images appearing fuzzy. Internet congestion periodically caused the video image to distort. Comments also point out that trainees preferred the videos to be short, helping them to avoid feeling overwhelmed. Lastly, commentary reflected that some trainees saw similarities between specific WebCT functions and third-party email software and, for at least one participant, this association fostered understanding of WebCT functions.

Training Video Title	Comments
Logging into WebCT	Improve the picture quality of the video. It was choppy and messy as it ran. It was difficult at time to see what was actually on the screen. It was fuzzy a few times but because the voice told me what was there, I knew what to expect. If possible it may be quicker to one-on-one demonstrations.
Modifying headers and footers	Good timing of the videos. They are not too long and don't make me feel overwhelmed. Because the screen is fuzzy it was hard to catch all of the information. There were several screens that were similar, but it didn't take too long to figure out.
Communication Tools Overview Part 1	This was less information to soak in. This was easier than the previous one.
Communication Tools Overview Part 2	This was easy to understand because it was just telling about the links and how they are similar to other things we use everyday.
Web CT Mail Overview	I think this is very basic, and I would expect most people to know it, but if they didn't this would help them. Again, this was easy to understand because it was an overview and because it works basically the same way email does.
Sending Mail through Web CT	This was easy to understand because it works just like regular email. Anyone who has used email will be able to understand it.
Using Bulletin Boards Part 1	Good timing on the videos. They are not long and don't make me feel overwhelmed. Because this is similar to email it is very easy to understand. It's still fuzzy at times.
Using Bulletin Boards Part 2	This was short and easy to understand.
Using Bulletin Boards Part 3	This worked well because it was explained twice. I could see what I was doing and it was immediately reflected on the screen.
Starting Chat	I have never been in or used a chat room so I don't know if this is similar but it was easy for me to understand.
Using Chat	This was easy to understand as well. It was similar to email and other functions on WebCT.

Table 4. Trainee Commentary About Instructional Videos

Discussion

Trainees' Use of the Videos

The researchers were in interested in examining how trainees used the instructional videos. They speculated that trainees might watch them while working in WebCT. For example, a trainee developing content in WebCT could open two browser windows, one of which contained a video and the other the WebCT workspace. He could then watch a video as needed while working.

Overall, trainees did not use the videos when working. They watched a video and, after it ended, opened the WebCT workspace to perform tasks without returning or reviewing the video. In a few isolated instances, they left the WebCT workspace to review a video only when an alternative solution to a task could not be found. When encountering a problem, trainees attempted to find a solution within the WebCT workspace (e.g., clicking WebCT options, etc.) prior to reviewing a video.

Trainees' Reactions to the Videos

Trainees perceived that their learning increased as a result of the instructional videos. From the video recordings, the researchers made two observations that appear to support this perception. First, trainees, when performing WebCT tasks, did so in the same sequence and using the same input information as presented in videos. Second, there are several functions in WebCT that, in the researchers' view, are not obvious to users. When the videos presented such tasks, trainees performed them. For example, the chat room video demonstrated how to send a private chat message, a feature not always apparent to users. When trainees performed tasks associated with the chat room, they each sent a private message. Had trainees not viewed the video, they would not have known about this task and how to perform it.

Trainees' perception that they learned from the videos, their high ratings of them, and the researchers' observation pertaining to the potential of the videos to support learning suggests that this mode of WebCT training is beneficial. Moreover, the videos can be created in a short development cycle without excessive time demands being placed on the developers.

The Video Split-Screen Evaluation Method

The researchers observed that the video-spit-screen evaluation technique provided several advantages. It enabled them to trace (visually and aurally) the actions taken by trainees and to monitor their use of the Web-based videos, including time on task, navigation of landscape, and options selected. At one point, a trainee could not get a WebCT chat room to open. Using the video, the researchers retraced the trainee's actions. There were able to view his verbal and non-verbal response and frustration with being unable to open the room. They reconstructed the actions he took attempting to open the room and the length of time he spent on this task before asking for help. They were also able to observe distractions or the series of actions that led to unsuccessful results and to make informed judgments (based on verbalizations) about the trainee's decision making.

The researchers felt that the video-split-screen technique was a useful data collection method but they noted three disadvantages. First, it requires evaluators to invest much time in data analysis. The split-screen method collects a large amount of data in multiple media formats. Proper analysis of them requires time, which may be prohibitive for some Web developers. Second, the approach requires specialized video and computing hardware that some developers do not own. Third, untrained evaluators need guidance or training in how to conduct evaluations. Only after a review of the video recordings did the researchers realized the extent to which their comments served as prompts to trainees and, in some cases, directed their actions. Untrained evaluators must ensure their questioning and prompting do not lead users.

Summary and Further Research

As described in this paper, the instructional video training appears to be a viable WebCT resource. An extensive development effort

was not needed to produce a worthwhile product that is easily modified and updated. These facts coupled with trainees' positive reactions to them suggest that the videos hold potential for training.

All the videos used in this study were streamed, which worked well since trainees had fast Internet connections. However, as training audiences extend to off-campus locations, slow Internet connections will, to a great extent, prohibit video training. Alternative delivery formats such as DVD and CD-ROM will be needed to reach geographically dispersed trainees.

This study was an initial attempt to observe trainees using and reacting to selected instructional videos and, in this regard, the video-split-screen technique yielded much data. The work presented here needs to be extended to more fully analyze the information collected and its implications for the design and delivery of video training. The video-split-screen technique presents the possibility of making more in-depth analysis of not only software evaluations but trainees' information processing and decision making as they are engaged with software.

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A Study Proving Effective Intranet Usage Improves Performance

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Abstract

Eighteen students were equally divided: Group A had textbooks while Group B did not have textbooks. "A" learned the course material via the text and lectures. "B" accessed instructor notes, lecture slides, and future probable test items via the instructors' Intranet program called "Blackboard." Prior to each examination, the instructor presented key words that had been thoroughly discussed. The students had to explain each item in one sentence demonstrating understanding. The midterm examination had sixty-two items valued at three points apiece, totaling 186. The average score for Group A was 132 while Group B averaged 164. On the seventy-item, 210-point final examination, Group A averaged 156 while Group B averaged 188 points. Hence, using different approaches for student learning does make a difference. Providing student access via an Intranet to the instructor's material and allowing pre-lecture knowledge of probable examination items significantly improves examination results and student learning.

Introduction

Normally, all students are taught and treated equally to avoid any hint of discrimination in the classroom. Those students in grammar school, however, are often subdivided into groups or categories based upon their level of knowledge, skills or ability to learn. Then the teacher endeavors to teach the students according to their level or group. Evidence[1,2] has shown this method to be quite successful even though the students in the lower level groups may only be expected to learn a small percentage of those in the highest group. The students are graded based upon the teacher's expectations for those within each distinctive group.

Other studies concerning group subdivisions in the classroom deal with what is called the "self-fulfilling prophecy."[3] In these cases the teacher does not actually subdivide the students and usually believes he/she actually treats all the students equally. But, mentally, those students believed to be superior are actually dealt with differently and their work performance is measurably better.

No previous studies can be found where a class of "equally qualified" students is taught identically but pre-class information differs between groups of students. Such a study was undertaken and the results are here in reported. Eighteen senior or graduate students were enrolled in the "Organizational Effectiveness" course, Spring 2000, at Arizona State University. This course investigated all aspects of human behavior in organizations, relevant theories to help interpret and understand such behavior, and probable effectiveness of both the organization and individuals. The author, a visiting professor at Arizona State University, discovered on the first night of class that the students were equally divided: nine students already had their textbooks by the same name as the course and nine students had not purchased their texts yet. This was an ideal situation for this research project although it may be classified as controversial. Another commonality was that both groups were equally comprised of one mid-twenties full-time graduate student and eight adult learners averaging thirty-two years of age and employed.

The class was informed of the overall objectives of the course and the andragogy method to be used throughout the semester. The instructor would use extensive PowerPoint slides that directly corresponded to the textbook content. Rather than using the typical lecture mode, an open discussion methodology would be followed. Through this discussion each student should master the true meaning and possible applications of each topic area. In fact, they should be able to thoroughly explain each topic using simple and easily understood language. This technique supports the instructor's belief "If the students have not learned, the instructor has not taught," and his definition of communication that is "The equal responsibility of both the sender and listener for the guarantee of mutual understanding." The students were also informed that their mid-term and final examinations would consist of key topical words or names of individuals discussed in the class. They would have to thoroughly define or explain each item in one sentence without using a typical textbook "What" answer. In their responses they would have to convey complete understanding of the word, topic or person. Further, during the week prior to each examination, the list of words and names would be presented. The class would approve of each item for inclusion in the examination. The basis for inclusion or omission would be the thoroughness of discussion during the class sessions. If a majority of the students voted in favor of an item, it was included in the examination.

Dividing The Groups

The nine students who already had their textbooks were not told anything unusual about their expectations. The course would follow the thirteen chapters in the 600-plus-page textbook. They were to read the material prior to each class so they would be prepared for discussion. They would notice that all the PowerPoint slides used in the class corresponded to similar material in the textbooks; however, not all the tables, figures, charts, etcetera would be used. The nine students who did not have their textbooks were given two options: (1) Buy the $121.00 book and learn from it as usual or (2) choose not to buy a textbook and obtain the course material from the instructor's Intranet "Blackboard" site. They would be able to access the instructor's presentation and discussion notes, copies of all the PowerPoint slides and a listing of the key topical words and people prior to each class session. All nine students opted for using the Intranet. They were then provided with confidential access codes and information sheets explaining how to use the "Blackboard" system.

The Blackboard System

Blackboard CourseInfo^{tm4} is an online teaching and learning server software product. Its purpose is to provide distance learning as an enhancement to traditional classroom instruction. Figure 1 shows Blackboard CourseInfo's four core features.

Content Management:

Posting course documents and assignments,
staff information, and incorporating files
from Microsoft Word, Excel or PowerPoint.

Communication and Collaboration:

Instructor and student interaction,
Mutual learning via discussion boards,
real-time chat opportunities, and
virtual office hours.

Assessment:

Create tests, quizzes and surveys,
Password-protected examinations, and
Performance feedback.

Administration:

Instructor Control Panel access,
Control of course content, communication,
assessment, and user management via
security permissions, and tracking student
usage

Figure 1. Blackboard CourseInfo Core Features

The instructor used all of these options other than Assessment since only one-half of the students had access to this Intranet information. All course information was provided using this site including the syllabus, course purpose and objectives, schedule, PowerPoint slides, discussion notes, key words and people as probable examination items and other pertinent student information. Grades and class ranking was included. A major feature of BlackboardCourseInfo that was a great benefit to the instructor was the virtual office hours. Eight of the nine students using this system were full-time employed and were often unable to schedule meetings with the instructor. They regularly used the virtual meeting aspect of the system, that was a confidential threaded discussion board one-on-one "chat."

The Mid-Term

During the week prior to the mid-term examination the instructor presented all the key topical words and people that had been discussed since the beginning of the course. Each item was again considered, questions pertaining to each were answered, and the students voted on each items' inclusion or omission to the test. The majority ruled. If one-half voted to omit an item, it was not included in the examination. The remainder of the items constituted the test. The students knew the procedure and scoring for this examination. They had to demonstrate their degree of "understanding"' of each item in one sentence. A textbook "What" answer would not garner any points since it would not show understanding.

The mid-term test consisted of sixty-two items each having a value of three points. Therefore, the total points for the mid-term examination was 186. The two groups were labeled by the instructor Group A, the text book group, and Group B, the Intranet group. Table 1 shows the mid-term test results.

	Total Possible	Average Score	%
GROUP A	186	132	71
GROUP B	186	164	88

Table 1. Mid-term Examination Scores

Group B did significantly better than Group A by an average of thirty-two points. Also, the range of scores differed greatly for the two groups. Group B ranged from a low of 153 to a high of 183; a difference of thirty points. Group A had a low of 96 and high of 154 for a range of fifty-eight points. The instructor's initial prediction based upon andragogy principles was accurate. Students who can organize and plan their own learning, with guidance, will do better than those who are required to follow a prescribed pedagogy method: read, take notes, memorize, and then forget following the examination.

At the next class session the mid-term examination results were told to the whole class. The instructor informed the students in Group A about Group B and how they were learning. The instructor avoided uproar, or charges of discrimination, by assuring all Group A students that their examination scores would be adjusted at the end of the semester following the final examination. However, they were encouraged to excel because they had a lot of points between themselves and those students in Group B. None of the students complained because of the assured adjustment with a guarantee of fairness.

Final Examination

The results of the final examination were almost identical to the mid-term examination. There were seventy items approved by the class. Again, each item was valued at three points for a total of 210. Table 2 shows the results for the two Groups.

	Total Possible	Average Score	%
GROUP A	210	156	74
GROUP B	210	188	90

Table 2. Final Examination Results

The average difference between the two groups was identical - thirty-two points. The range for Group A was much less than in the mid-term examination. Group A scores ranged from a low of 142 to a high of 178 for an overall range of thirty-six. Yes, the lowest and highest Group A students were the same on both the mid-term and final examinations. The range for the Group B students was much narrower: a low of 178 and a high of 200.

Table 3 shows the combined results of the mid-term and the final examinations. Also shown are the adjusted Group A scores. The instructor added thirty points to each student's mid-term and final examination scores.

	Total Possible	Average Score	%
GROUP A	396	288	73
GROUP B	396	352	89
GROUP A (Adjusted)	396	348	88

Table 3. Overall Examination Results

The instructor equalized the scores as closely as possible. The Group A student who had the high-test score in that group was within thirty-two points of a perfect score on both the mid-term and final examinations. That student, incidentally, completed the course with the highest test score average. The applied adjustment and exactly how it was reached was thoroughly explained to the students. They all expressed their satisfaction.

Conclusion

The results of this study are highly conclusive even though the sample size was quite small. Different approaches for student learning does make a difference. Those students who had access via the instructor's Intranet site and could utilize actual course material scored significantly better than those students who followed the typical "learn from the textbook" approach. All students participated in the discussions and helped equally to determine examination content. But, those students who had access to the instructor's discussion notes and prior knowledge of probable examination items before each class could isolate their concentration on the most pertinent and valuable content. Their learning was under their individual control.

Although the sample size of this individual study was quite small, the author feels quite strongly about these results and his personal experiences such that he strongly recommends instructors reevaluate how they are providing learning opportunities for their students. With an Intranet system similar to Blackboard, the burden of learning is transferred to its rightful source with the students. Another benefit is the virtual office hours utilizing on-line one-on-one chat room capabilities. This student preparation process can be used for virtually every course regardless of its content. The ultimate objective is for the students to learn at their maximum potential.

A word of caution must be given, however. Any instructor wanting to a similar study must guard against any possible discriminatory practices. Any and all groups must be treated equally in the final grading.

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Blackboard CourseInfo; www.blackboard.com

Integrating Assessment and Research Strategies On a Large Development and Research Project: Kids as Airborne Mission Scientists (KaAMS)

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Abstract

Combining assessment and research components on a large development and research project is a complex task. There are many descriptions of how either assessment or research should be conducted, but detailed examples illustrating integration of such strategies in complex projects are scarce. This paper provides definitions of assessment, evaluation, and research and illumination on how to strategically integrate and manage assessment and research activities by providing examples of tools used to develop and manage a comprehensive assessment and research plan for Kids as Airborne Mission Scientists (KaAMS), a large instructional development and research project.

Introduction

Kids as Airborne Mission Scientists (KaAMS) is a large development and research project funded by the National Aeronautics and Space Administration's (NASA) Leading Educators to Applications, Research, and NASA-Related Educational Resources in Science (LEARNERS) project. The purpose of the KaAMS project was to develop a series of teacher resources, framed in interdisciplinary problem-based learning approaches integrating authentic and ill-structured problem situations, inspiring teachers to inspire students to pursue the sciences. The goal of the project was to develop *informed* instructional materials and *assess* their impact on the target audiences, middle school teachers and students. Thus, the project proposal included a strong commitment to formative and summative evaluation as well as a research component.

Definitions

Assessment is an umbrella term that refers to the systematic study of a problem or innovation to make effective decisions about what should happen (Rossett, 1987). In the case of the KaAMS project, the assessment plan defined the objectives, strategies, tools, and protocols used to collected formative and summative feedback.

The formative evaluation component of the assessment plan answered the question 'how are we doing?' as instructional materials were being developed (Morrison, Ross & Kemp, 2001). The focus of formative evaluation was on measuring the effectiveness, efficiency, usability, and acceptability of the material produced so that sound instructional design decisions could be made as the materials were developed and finalized. Feedback collected during formative evaluation served the function of informing the development team how well each of the instructional materials were serving the instructional objectives and what should be done to enhance them.

The summative evaluation procedures were designed to answer the question 'how did we do?' after instructional materials had been implemented with the target audience (Morrison, Ross & Kemp, 2001). Summative feedback focused specifically on the degree to which the major instructional outcomes were attained as a result of using KaAMS materials. Summative evaluation addressed (1) reaction, (2) learning gains, (3) performance changes, (4) education system changes, and (5) impact on the greater society. This feedback was useful in developing implementation plans and supporting materials to train new teachers in the use of KaAMS materials.

Research, on the other hand, is a process of identifying something unknown and then collecting data to make it known (Gall, Borg & Gall, 1996). In the case of KaAMS, the research components focused on analyzing the effect that using KaAMS had on the stakeholders in the middle school learning environment. For example, it was unknown how teaching strategies would be affected by introducing KaAMS into the classroom or whether the use of these materials would affect student interest in pursuing science. Answering such questions can help researchers develop a better understanding of the types of materials and activities that affect instructional and learning processes.

Thus, the purpose of assessment is to gather feedback that will inform the instructional design process. The dangers of having incomplete and poorly thought out assessment strategies are that either required feedback is not collected or time is wasted collecting feedback that is not important to design-enhancement decisions. Thus, the focus of a good assessment strategy must include plans and instruments for collecting feedback that is essential to drawing conclusions about what is needed to develop great instruction. The purpose of research is to gather data on the impact that instructional materials have on stakeholders and the instructional and learning environment. Poor planning of the research data collection process can result in obsolete data, lost opportunities to collect needed data, or data collection conditions that interfere with gathering reliable data. Thus, strategic collection of research data must also be tied to the development process, based on the key research questions, provide flexibility for adjusting to new learnings during product development phases, and seek data that can test theoretical assumptions.

Although assessment and research literature provides guidelines to develop, manage, and conduct assessment or research, comprehensive examples illustrating how to integrate assessment and research strategies, methods, and tools could not be found in the literature. Published literature on large-scale development and research projects usually contained only brief descriptions of certain components of assessment and research often neglecting to provide detailed descriptions of the relationship among development cycles, feedback and data collection procedures, and assessment and research tools. Therefore, decision-making about design and implementation issues can be problematic if the right amount or right kinds of feedback and data are not collected. Examples that illustrate the integration of assessment and research strategies and tools are scarce. Sharing such examples is therefore beneficial to others developing comprehensive and targeted assessment and research plans. The remainder of this paper will describe and provide examples of the tools and procedures developed to manage and conduct assessment and research on the KaAMS project.

Strategic Planning of Assessment and Research Cycles

The challenge in creating a strategic approach to assessment and research began with identifying the formative and research needs of the project. The literature on instructional development formative and summative evaluation provided guidelines for determining the types of feedback needed to develop sound instructional materials (Dick and Cary, 1985). The scope of the KaAMS project helped to determine who, e.g., teachers, administrators, students, curriculum specialists, would best be able to provide such feedback. Thus, during the development of the KaAMS lesson plans feedback was sough from middle school administrators, teachers, and students on the layout of the material, background resources, terminology, appropriateness of activities, time dedicated to preparation, impressions after using the materials, and thoughts on what worked and what did not during the use of the materials. This feedback was gathered during and immediately after the initial classroom testing of KaAMS.

The research questions were drawn in-part from the purpose of the grant, a literature review on problem-based learning, technology integration in the schools, and career development in adolescents and in-part based on the researchers interests. The research questions probed for understanding on the effects of KaAMS on: (1) teachers use of KaAMS and NASA resources in their classrooms, (2) changes in teaching practices during and after using KaAMS materials, (3) changes in students' success rates in science, (4) changes in students' interests in pursuing science, and (5) diffusion of KaAMS and NASA materials to the surrounding educational environment.

Three cycles of development and data collection

Being a large development project, lasting three years and consisting of collaborations among two major universities, several NASA scientists, and several schools, the KaAMS products were developed in three cycles: alpha, beta, and final versions. The frameworks for the PBL units and major lesson plan components were developed during the alpha cycle. The alpha version was developed based on collaboration among the KaAMS project team that included a group of advising middle school teachers who reviewed and classroom tested the KaAMS materials. Assessment of the alpha materials focused on the appropriateness of the level of content and activity for the students, background information and instruction for teachers, and general organization of lesson plans and associated lesson components.

The beta cycle focuses on using developing a beta version of KaAMS that incorporates learnings from alpha testing, including modifications needed to activities and development of support materials to meet the needs of teachers. Beta testing is conducted with a new set of teachers from a broader group of teachers and students spread across three states. Beta testing focuses on the usefulness of the completed product and how teachers integrate the lesson plans or lesson components into their curriculum. This feedback helps to finalize the KaAMS products and teacher support resources and develop national distribution plans. Simultaneously, research data were, or will be, collected to establish measurement baselines and gather further data on the effects of KaAMS on teachers, students, and the surrounding community. During Alpha testing the research instruments, protocols, and logistics were be tested.

The assessment and research matrix

The first step in developing the overall assessment plan was to document and examine the assessment and research needs. The assessment and research questions were placed in a matrix to develop a strategic view of the feedback and data requirements for the project. The formative and summative feedback needs were cross-referenced to the data collection instruments and questions by subject, e.g., teacher, student. See Table 1.

Table 1. Example from KaAMS Research and Assessment Matrix: Lesson Plan Development – Formative Evaluation

Lesson Plan Development - Formative Evaluation

Stakeholders/ Instruments / questions	impressions of layout, terminology, etc. of lesson plans	value / needs of background resources	connections to the curriculum, terminology	value / usefulness / appropriateness of activities and resources
TEACHERS				
TAP A initial interview				
Teacher background	Q4-5			
Curriculum connections			Q1-3	
Lesson plan impressions	Q6-7			Q8
Background content		Q10-13		
Classroom use	Q15			
Discuss KaAMS w/others				
LP Follow-up survey				
lesson used		Q4		Q5
resources used				Q8-9
classroom description during lesson		Q18	Q17, Q23-24	Q19-22
student success				
STUDENTS				
Student focus groups	X	X	X	X
Student classroom documents		X		X
Student journals		X		X

* B=baseline, A=immediately after use, L= long-term follow-up, 1 to 6 months after use P-During prep, Q=question

The research questions were also cross-referenced to the data collection instruments and questions by subject, e.g., teacher, student. See Table 2.

After cross-referencing all of the feedback and data needs by instrument and stakeholder the matrix was examined for gaps and overlap. Instruments and protocols were adjusted to collected feedback and data that were not accounted for in the matrix. For example, it was found that student opinion and artifacts were gathered to assess student success rates, but teacher feedback was not gathered on student success. Questions were added to interview protocols to gather such feedback.

Analysis of the overlaps indicated that there were several instruments and questions gathering feedback on the materials. Since this goal of the project was to develop new instructional materials it was agreed that the level of overlap, especially since feedback was from multiple perspectives of the teachers and students, was appropriate. To ensure that the data collection was not too obtrusive to the learning environment, the next step was to plan the timing for administration of the data collection instruments and protocols.

The assessment strategies protocols called for continual gathering of feedback from teachers and students through multiple strategies, e.g. surveys, interviews, and observations. The KaAMS product development plan laid out the calendar timing for the development and testing of each component of the instructional materials. Examining each instrument and protocol provided an estimate of how long each stakeholder would be required to provide solicited feedback and data. Thus, the timing, by calendar date, and timing in terms of stakeholder commitment in providing feedback through the various instruments were examined. Time frames were established for administering data collection instruments based on the project development timelines and collection patterns for the most appropriate data that would be least invasive to those involved. These estimated timelines were added to the KaAMS Research and Assessment matrix. See Table 2, freq columns.

Table 2. Example from KaAMS Research and Assessment Matrix: Research

KaAMS Research Stakeholders/ Instruments / questions	How are teachers using KaAMS and NASA resources?	* freq	How are teachers changing their teaching practices?	* freq	How are student success rates in science changing over time?	* freq	How are student levels of interest in pursuing science-related career changing over time?	* freq
TEACHERS								
Electronic survey								
demographics			Q103, Q114-115, Q122-136	BAL				
teacher attitude			Q1-31	BAL				
percept. of env. for web			Q32-52	BAL				
methods of teaching			Q53-78, Q112-113	BAL				
Resource use			Q79-102, Q104-110, Q111	BAL				
Importance of NASA, Aero, RS to curric.			Q116-121	BAL				
LP Follow-up survey								
lesson used								
resources used	Q8-9	A						
classroom description during lesson			Q10, Q16, Q27	A			Q19-22	A
student success					Q13, Q15	A		
Classroom Observations	X	D					X	D

* B=baseline, A=immediately after use, L= long-term follow-up, 1 to 6 months after use P-During prep, Q=question

One additional benefit of the strategic matrix was in providing an overall picture of the project development, assessment, and research components. Thorough review of the matrix provided insights into the complexity of the research agenda. This prompted the development of a strategy to use the alpha testing cycle to test the research protocols. This would allow the team to refine logistics for data collection and identify initial findings related to the effects of using the KaAMS materials with middle school populations. However, it is important to report such findings with caution, since effects may be related to additional attention from product development teams.

Additional Planning and Managing Tools

The strategic planning matrix provided the framework for a comprehensive Assessment Plan to be used by the project team to manage the assessment and research processes. The components of the Assessment Plan included text and graphic representations of the overall assessment strategy, teacher advisory panels for alpha and beta testing, roles and responsibilities of assessment team members, components of each evaluation and research procedure, development and data collection timelines, selection criteria for participants, forms for tracking procedural issues, copies of all instruments and protocols, and human subjects approval forms. The Assessment Plan was developed so that each component was tied to the research matrix supporting the data collection needs while keeping the amount of disruption to subjects at a minimum.

The strategic planning matrix also provided the framework for creating a database for all data collected during the assessment and research phases. In this case, a spreadsheet was developed with multiple worksheets. Each worksheet was titled based on the instrument, stakeholder and type of data it collected. This naming structure ultimately helped in the data analysis processes.

The final assessment and research report was also based on the strategic planning matrix. The matrix provided an overview of the data requirements in response to the evaluation and research questions. This overview was used as the planning structure to analyze the data collected and to report on findings based on the project questions. The final assessment and research report included text and graphic representations for an executive summary of the assessment and research findings, a short summary of the project goals and assessment and research objectives, summary of the formative and summative evaluation feedback and recommendations for each component of the KaAMS material, tables and figures describing results, summaries of the observations and data collected from each classroom, baseline and subsequent description of each stakeholder in the classroom trials, and appendices that described each of the lesson plans tested, detailed notes from observations, interviews, and focus groups, and selected printouts of data analysis on stakeholders. Thus, the information in the summary report was linked to the other assessment and research tools developed for the project, based on the framework established in the strategic planning matrix.

Conclusions

Combining assessment and research components on a large development and research project is a complex task. Creating strategic planning tools can help visualize the feedback and data needs and provide a framework for creating overall assessment and research plans, data collection schedules and instruments, and summary reports.

During KaAMS, several levels of assessment and research were conducted and data were collected from several stakeholders. A planning matrix was created to avoid over- and under-collection of data and assure that the appropriate data were collected. The matrix provided a strategic tool to help cross-reference the collection of different data, at different times, from multiple stakeholders. It helped to identify weaknesses and strengths of the assessment strategies and guided further development of instruments and protocols. The key benefit of such as matrix was in its value to provide a framework for creating an overall Assessment Plan that helped coordinate assessment and research team members during data collection, data analysis, and reporting. This tool, thus, helped to plan and manage the complex task of gathering the right type of feedback and data, at the right time, from the right stakeholders during a large, multi-year development and research project.

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How and Why Students Play Computer-Based Mathematics Games: A Consideration of Gender Differences

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Abstract

This research was recognized with the 2000 Robert M. Gagné Dissertation Award from the AECT Division of Instructional Development. The study, both qualitative and quantitative, focused on gender differences in the use of a computer-based mathematics game. High school level males and females were compared in their game-playing and learning strategies, motivation to use a computer-based mathematics game, beliefs about mathematics and computers, and mathematics performance. The evident gender differences and instructional design implications are discussed.

Introduction

When computer-based games are developed for learning, consideration must be given to gender. Males and females report different reasons for motivation to play computer-based games (Dempsey, Lucassen, Haynes, & Casey, 1997; Malone, 1981). Along with differing views for motivation, males and females report differences in the use of metacognitive and cognitive strategies. Metacognitive strategies are used to monitor and regulate progress toward a goal (Flavell, 1981). Metacognitive strategies are also known as comprehension monitoring strategies (Smith & Ragan, 1999). Cognitive strategies are strategies selected by learners to process information and solve problems (Gagné, Briggs, & Wager, 1992). Metacognitive strategies govern the use of cognitive strategies (Gagné, et al., 1992). Learners can examine their use of cognitive and metacognitive strategies to improve their performance in computer-based instructional games (Jacobs & Dempsey, 1993).

The now classic ARCS Model of Motivation (Keller, 1983; 1987a; 1987b) is relevant to the study of motivation and the use of computer games to motivate learners. The ARCS Model of Motivation includes four categories of conditions that affect the motivation to learn. The four categories are attention, relevance, confidence, and satisfaction.

In a frequently cited study of computer-based games, Malone (1981) proposed a theory of intrinsically motivating instruction. Malone developed his theory to include three categories: challenge, fantasy, and curiosity.

In this study, evidence emerged that fit with Keller's (1983; 1987a; 1987b) ARCS Model of Motivation and Malone's (1981) theory of intrinsically motivating instruction. Males and females reported different game-playing strategies and different reasons for motivation. Consequently, guidelines are needed for the design of computer-based instructional games that are appealing and motivating to learners regardless of gender. Finding exceptional ways to design and develop computer-based instructional games has the potential to assist all learners in improving their confidence in mathematics ability and beliefs about mathematics and computers.

Purpose and Scope of the Study

The purpose of this study was to compare high school level males and females in their game-playing and learning strategies and their motivation to use a computer-based mathematics game. In addition, males and females were compared in their beliefs about mathematics and the use of computers. Comparisons were made also for mathematics performance.

Gender differences in learning have been researched in various areas such as mathematics performance (Friedman, 1989; Hyde, Fennema, & Lamon, 1990), attitude toward mathematics (Hyde, Fennema, Ryan, Frost, & Hopp, 1990; Kaiser-Messmer, 1993), and attitude toward the use of computers (Shashaani, 1994; Taylor & Mounfield, 1994). Gender differences in the use of computer-based games, however, have not been examined extensively (Dempsey, Lucassen, Gilley, & Rasmussen, 1993-94). In a review of 51 instructional gaming articles (Dempsey, et al., 1993-94), the authors note that the articles were unclear in reporting learner characteristics such as cognitive style or demographics such as gender, race, and age. Along a similar line of thought, the American Association of University Women [AAUW] (1992) points out that research reports frequently refer to students without specifying gender and fail to explore links between gender and academic performance.

Method

Participants

The participant population included five ninth-grade classes of students (58 females and 52 males) enrolled in Algebra I at a private parochial school in the Southeast region of the United States. Entry to the school was arranged through a fellow graduate student who is an administrator at the school. The classes each had 19 to 23 students (N = 110). To assure confidentiality, an identification code number was assigned to all participants. Because the number of computers was limited to 17, participants were randomly assigned to work in pairs with a student of the same sex.

Facilities

Students played the game in the school library. The library had a separate room with 17 IBM-compatible PC computers. The computers were arranged in a rectangular shape facing the walls.

Instructional Materials

A commercially developed software program was used in the study. The software, produced by The Learning Company (1997), is called *Grade Builder Algebra 1* (1997). It includes a tutorial and two games related to the algebra topics. One of the games (*Soak Your Sibling*) was used in this study to review previously learned algebra topics. The Learning Company donated the software for this study. The software remained with the school upon completion of the study.

The treatment was the use of a computer-based mathematics game to review algebra topics. The participants learned the algebra topics two to three months before this study took place. The game questions included, for example, linear equation problems. For the linear equation problems, the participants identified where an animated character was hiding by typing the missing values of the line's equation.

Research Questions

Six major questions were considered. The first question on strategies was studied with the use of qualitative data. The second question on motivation was examined with qualitative data supplemented by quantitative data. The remaining questions were answered primarily through quantitative data with supplemental qualitative data.

Research Question 1: What strategies will be reported by males and females following the use of a computer-based mathematics game?
Research Question 2: What will males and females find motivating about a computer-based mathematics game?
Research Question 3: Will there be a difference between males and females in their beliefs about mathematics, controlling for prior beliefs, following the use of a computer-based mathematics game?
Research Question 4: Will there be a difference between males and females in their beliefs about the use of computers, controlling for prior beliefs and spatial visualization, following the use of a computer-based mathematics game?
Research Question 5: Will there be a difference in the scores of males and females on an immediate posttest, controlling for pretest scores, following the use of a computer-based mathematics game?
Research Question 6: Will there be a difference in the scores of males and females on a delayed posttest, controlling for pretest scores, following the use of a computer-based mathematics game?

Research Design

This study was qualitative and quantitative. The qualitative data included researcher observations and focus group interviews. Interviews are important because thoughts and feelings cannot be observed (Patton, 1990). In addition to the observations and focus group interviews, daily journals and personal letters written by students provided insight into the students' learning and game-playing strategies, as well as their motivation to play the game.

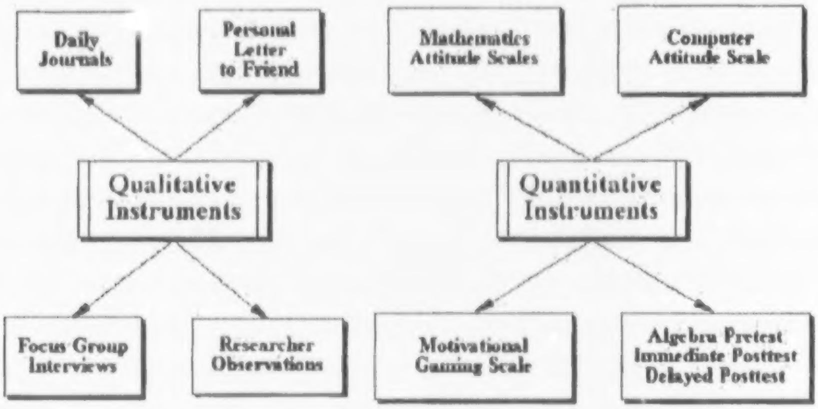
The quantitative data included results from the Visualization in Two-Dimensions Test (Flanagan, Davis, Dailey, Shaycoft, Orr, Goldberg, & Neyman, 1964), the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976), the Computer Attitude Scale (Shashaani, 1993), and a Motivational Gaming Scale (Dempsey, Lucassen, Haynes, & Casey, 1997). The Motivational Gaming Scale is based on Keller's ARCS Model of Motivation (Keller, 1983; 1987a; 1987b). The scale is a modification of Keller's Instructional Motivational Scale (Keller, 1987c). The Likert-type scale includes statements related to attention, relevance, confidence, and satisfaction. Pretest scores, immediate posttest scores, and delayed posttest scores provided reports of mathematics performance.

Combining methodologies and using multiple data sources is known as triangulation (Creswell, 1994). Triangulation helps the researcher to "cross-check" information and conclusions by using multiple procedures or data sources (Johnson, 1997). A graphic organizer for the instruments is displayed in Figure 1.

Independent and Dependent Variables

For the quantitative analysis in this study, the independent variable was gender. The dependent variables included beliefs about mathematics, beliefs about the use of computers, gaming motivation, mathematics performance on an algebra immediate posttest, and mathematics retention measured by an algebra delayed posttest. Spatial visualization was a covariate for beliefs about computers. Prior beliefs were covariates for beliefs about mathematics and computers.

Figure 1. Qualitative and Quantitative Instruments



Procedures

On the first day of the study, the participants remained in their regular classroom and completed an algebra pretest and the Visualization in Two-Dimensions Test (Flanagan, et al., 1964), The next day, the participants completed a demographic questionnaire, the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976), and the Computer Attitude Scale (Shashaani, 1993). The participants were randomly assigned to work in pairs with a student of the same sex in the computer laboratory. Four class sessions were devoted to playing the game. Near the end of the class session, the students completed a three-page Daily Journal form to describe their experience. The students described the strategies they employed, as well as elements they liked or disliked about the game. In addition, students described successful and unsuccessful situations, along with their attributions for success. A sample of the journal questions is shown in Figure 2. After the four days, participants again completed the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976), the Computer Attitude Scale (Shashaani, 1993), and the Motivational Gaming Scale (Dempsey, et al., 1997). The next day, the participants completed an immediate posttest on the algebra topics. Two weeks later, the participants completed a retention test on the algebra topics. Three days after the immediate posttest, the students participated in focus group interviews. For each of the five algebra classes, two separate focus group sessions were conducted. One focus group consisted of males only. The other focus group consisted of females only. Each focus group session lasted approximately 20 minutes. Upon arrival at the focus group session, the participants submitted a personal letter to a friend that described their experience with the game and the strategies they used.

Figure 2. Sample Questions from the Daily Journal

What steps did you take to play the game today? In other words, what was your Plan of Action?

Describe a situation where you were *most* successful today. Explain why you were successful.

What do you remember enjoying *most* today?

What do you remember enjoying *least* today?

Data Analysis

The statistical software *SPSS 6.1* (1994) served as the primary tool for the analysis of the quantitative data. Chi-square tests were used to analyze gender differences in the responses to the Demographic Survey and Game Survey Part I. Game Survey Part I was developed primarily to determine if students had played the game before and to see if the participants felt in control of the technical aspects of the game, such as using the mouse and keyboard. Descriptive statistics were used with the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976) and the Computer Attitude Scale (Shashaani, 1993). Analysis of covariance (ANCOVA) was used to examine differences between males and females in their beliefs about mathematics, controlling for prior beliefs. ANCOVA was also used to examine differences between males and females in their beliefs about the use of computers, controlling for prior beliefs and spatial visualization. ANCOVA was used to examine the algebra posttests. The algebra

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pretest was the covariate. The Motivational Gaming Scale (labeled as Game Survey Part II) was examined with factor analysis. T tests were conducted for gender differences on the factor scores. Chi-square tests were used for a follow-up analysis on individual Motivational Gaming Scale items.

For this study, some of the statements were modified to be more specific to reviewing algebra with a computer-based game. The estimated reliability of the scale was .89 (Cronbach's alpha). In an earlier study (Dempsey & Johnson, 1998), the estimated reliability was .64 (Cronbach's alpha).

A qualitative software program, *QSR NUD*IST 4* (1997), was used in the analysis of the qualitative data. The acronym NUD*IST stands for Non-numerical Unstructured Data * Indexing Searching and Theorizing. The software can be used for coding data in an index system. When all the qualitative data were coded for this study, the resulting index system was exported to the software program, *Inspiration 4.0* (1992) in the form of an outline.

The coded qualitative data were submitted to a peer reviewer. As a result of the comments and suggestions from the peer reviewer, modifications were made to the coding. Peer review is a strategy used to promote validity in qualitative research (Johnson, 1997).

Results and Discussion

Strategies

Evidence emerged that showed differences in males and females and their reports of strategies. Females gave more evidence of using metacognitive, cognitive and cooperative strategies. Males gave more reports that they did not have a specified strategy. Both males and females showed evidence that their strategy was to challenge themselves.

Malone (1981) suggests that learners can be challenged by uncertain outcome. Malone recommends four strategies for achieving uncertain outcome: varying the level of difficulty, designing multiple-level goals, hiding information, and introducing randomness. The students discovered ways to vary the level of difficulty and make the game suitable for their skill level by selecting algebra problems accordingly. Multiple-level goals were reported by students whose strategies included working quickly, beating the timer, and solving the problem mentally or working the problem in their head.

The students demonstrated a connection between motivation and the use of strategies. Malone (1981) recommends motivating students to learn by presenting just enough information to make the learner's existing knowledge seem incomplete, inconsistent, or unparsimonious. The students demonstrated their ability to recognize when their existing knowledge was incomplete by reporting the use of metacognitive strategies. For example, one male wrote in his Letter to a Friend, "Every day before I played, I learned the formulas to the problems I was doing. This helped me understand the problem better when I played the game." A female student wrote in her Daily Journal, "Review the material since we have not looked at it in a while."

With respect to cognitive strategies, females ($n = 34$) gave twice as many reports as males ($n = 17$) for solving problems on paper. As a cooperative strategy, females ($n = 16$) showed a much greater use of comparing individual answers than males ($n = 4$). The cognitive and cooperative strategies appear to have a linkage. The linkage appears to be where females compared individual answers (a cooperative strategy) that they solved on paper (a cognitive strategy).

Motivation

In the analysis of motivation, categories emerged that fit with Keller's (1983, 1987a, 1987b) ARCS Model of Motivation and Malone's (1981) theory of intrinsically motivating instruction. Females showed higher motivation with respect to relevance of the game as a learning tool (e.g., finding the game helpful). In addition, females indicated higher motivation through satisfaction (e.g., finding benefit of examination review). Males were more highly motivated by challenge in terms of building self-esteem (e.g., achieving a high score). Both males and females showed evidence of gaining satisfaction from positive consequences (e.g., reporting the game as fun, enjoyable, good, or great). Both males and females were motivated by confidence generated by success opportunities (e.g., solving problems, learning new formulas).

Keller (1987a) points out that success opportunities promote confidence. Keller emphasizes the importance of allowing learners to have meaningful success experiences as soon as possible to stimulate continued motivation. Numerous citations in the Daily Journals illustrate the success of both males and females. The following quotes were written by female students in response to the question, "What did you enjoy most today?" "Figuring them out, finally!" "Finally figuring them out." "Figuring out slope and distance." "Knowing how to solve the problem." "Finding out we were right." "Learning how to do the problems." "Remembering how to do the problems." "Finally understanding slope-intercept." (The student drew a smiley face next to her response.)

Male students wrote similar responses in the Daily Journals to illustrate their success. The following quotes are examples of what they wrote in response to the question, "What did you enjoy most today?" "When I got [illegible] long problem." "Learning and solving problems." "Having more of a challenge by working all of the problems." "Figuring out the problems." "Answering problems correctly." "Learning a new formula." "Learning distance formula." "Remembering."

Both males and females indicated repetition as a problem with sustaining attention to the game. Males indicated a desire for instructional games to include elements of entertainment games, such as 3D images and violent fantasies, to attract their attention. Although the issue of violence was raised only in the focus group interviews, ignoring the implications is difficult. The issue arose primarily in discussions of why more males play computer games and whether the game used in this study was appropriate for both males and females. The researcher presented no violence-related questions. The following dialogue illustrates the students' ideas about violent themes in games.

"Tell me what you think about the *Soak Your Sibling* game for males and females. Is it more interesting to males or females or both? " A female student said, "If they pulled out a Tommy gun, guys would like it more."

Similarly, in another focus group interview, one male said, "It needs to add some violence." The researcher asked, "Violence? You think it needs more violence?" The student responded, "Yeah. Like a guillotine to chop off your head." Another male offered a less violent solution by saying, "Males would like it more if it had sports."

Beliefs About Mathematics and the Use of Computers

Before and after student use of the game, t-test results of the attitude scales showed that males were more likely than females to stereotype both mathematics and computers as male domains. Although the qualitative data from the focus group interviews gave some indication of gender-based stereotyping, both males and females gave evidence during the interviews that they did not hold stereotypical views about mathematics and the use of computers. Females also recognized that stereotypical views stem from societal expectations and are more often views that are held by males.

Mathematics Performance

The results did not show a statistically significant difference between males and females in their immediate posttest or delayed posttest scores. The results did not support the research hypotheses that males will score higher than females on an immediate or delayed posttest following the use of a computer-based mathematics game. The results on the delayed posttest, however, indicated a tendency toward statistical significance ($p = .070$) with females performing better than males.

Implications

Both males and females demonstrate the development of cooperative, cognitive, and metacognitive strategies when playing a computer-based mathematics game. The use of games, such as the one used in this study, may be disadvantageous to males, however. If males have more experience with computer-based games, especially violent games, they may be less likely to see the benefits of games to their learning. Females, on the other hand, may benefit from the use of this type of computer-based game because they are more likely to see the value of the game as a learning tool. The evident gender differences indicate the need to design games that are appealing to both males and females. The development of various game fantasies will allow students to make choices that are more relevant to the student. In addition, allowing students to choose the level of difficulty promotes challenge and success opportunities.

Conclusion

Both males and females are interested in the use of a computer-based mathematics game, although they take a different approach and have different reasons to engage in the game. Designing computer-based mathematics games that appeal to both males and females supports the learners' development of cooperative, cognitive and metacognitive strategies. Games that are designed with varying levels of difficulty challenge learners to succeed without damaging their self-esteem. Designing games that challenge learners to succeed assists the learners in building confidence in their mathematics ability.

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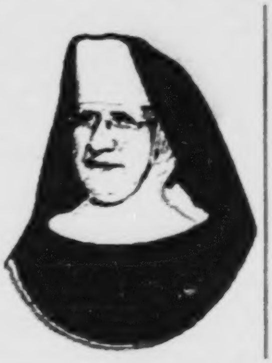
Sister Mary Theresa Brentano, OSB's Innovative Use of Magnetic Audio Tapes: An Overlooked Story in the History of Educational Technology

Linda Herndon, O.S.B.

> *"The keenest disappointment of our trail blazing would be that we could not fit into the picture of new developments."*
> from Brentano's daily journal calendar, January 5, 1959

Introduction

In this paper, I tell the story of Sister Mary Theresa Brentano, O.S.B.'s (1902-1987) innovative use of magnetic audio tapes to provide instruction for students in grades K-12. From 1952 to approximately 1968, Brentano implemented, refined, and tested her tape teaching methods with special emphasis on individualizing instruction in the elementary school. Brentano's innovative tape teaching ideas are not mentioned in Saettler's *The Evolution of American Educational Technology* (1990), DeVaney's *Voices of the Founders: Early Discourses in Educational Technology (1996)*, or Butler's *Women in Audiovisual Education, 1920-1957: A Discourse Analysis* (1995). In this paper I provide interpretive biographical look at Brentano's tape teaching innovation. I discuss her rationale for and implementation of tape teaching and share some of the successes and struggles of tape teaching. I conclude by discussing two ways my research into Brentano's individualized tape teaching innovation benefits the field of educational technology.



Sister Mary Theresa Brentano, O.S.B. was a Benedictine Sister of Mount St. Scholastica in Atchison, Kansas.[1] In June 1933, Brentano, a member of the Phi Beta Kappa honor society, received the first Ph.D. in English awarded by the University of Kansas ("City News," 1933). After receiving her Ph.D., Brentano returned to the college run by her religious community, Mount St. Scholastica College[2] in Atchison, Kansas, as head of the English Department.

Sometime during the 1947-48 school year, Mother Walburga (Anna) Franz, Prioress of St. Scholastica Priory, Covington, Louisiana, came to Atchison, Kansas, to confer with Mother Lucy Dooley, Prioress of Mount St. Scholastica, about the possibility of sending a few Sisters to Covington. Franz wanted some sisters from Atchison who had their Ph.D. to go to Covington to help the sisters maintain state certification of their school, St. Scholastica Academy, by teaching some classes to their sisters. Brentano was one of two sisters from Atchison who volunteered to go to Louisiana in the fall of 1948.

The Inspiration for Tape Teaching

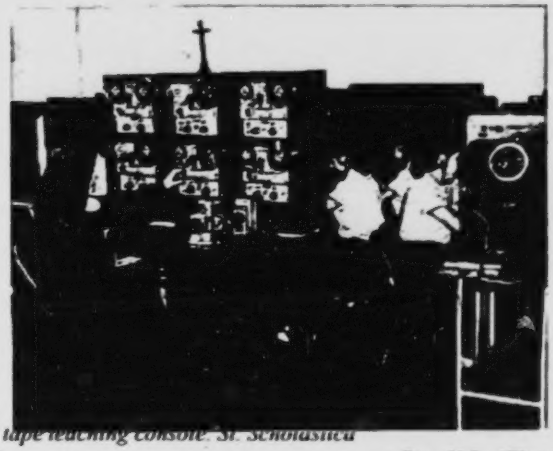
Sometime in 1952 while she was principal of St. Scholastica Academy in Covington, Brentano and Franz went on a trip to New Orleans. While riding in a taxicab there, Brentano noticed that the cab driver could call his headquarters to get his orders to find out who to wait for and where. Brentano got the idea that if the taxi driver could talk over the intercom and communicate with headquarters, then why couldn't this same technology be used in a single classroom with the different students hearing the teacher whenever she talked to them. (M. P. Ege, OSB, personal communication, November 6, 1999)

With the full support of Franz, Brentano set about to make her germ of an idea for individualized tape teaching a reality. Having previously observed the use of tape recorders and earphones to teach graduate students foreign languages ("Classroom electron," unknown; Stoma 1957), she decided to use this technology to provide the individualized instruction that parents were requesting for their daughters and sons. Although we now think of individualized instruction as meaning each child is taught according to his or her needs, for Brentano individualized instruction meant that a child's individual needs were important, but for instructional purposes, the child is grouped with other children who have similar needs. She referred this method as "individualization within the group" (1959). Brentano described individualized tape teaching as "probably the greatest aid now available for taking care of individual differences in the classroom" ("Sisters Prepare Tape Recorded Lessons," 1954?). The huge increase in the student population as the Baby Boomers started school created a teacher shortage and individualized tape teaching was touted as a possible way to help to alleviate this problem.

Tape Teaching–What It Is and How It Developed

A class period taught using Brentano's individualized tape teaching methods was divided into three sections of about 20 minutes each (Keating, 1961). During the first section of the class period, the teacher introduced the class's topic. The teacher then divided the students into four ability groups. While three groups used earphones to listen to tapes prepared by their teacher on the topic, the teacher worked with the fourth group that needed extra help. The brightest students heard on tape how to apply what the teacher had presented. The average students got some clues or reminders about how to apply what was presented while the slow learners had the entire lesson repeated, possibly more than once (Stoma, 1957). The last section of the class period was a total-class discussion where students had a chance to share what they learned from listening to the tapes. A former tape teacher shared with me that Brentano encouraged her to make sure that the low ability students always had some information on their tape that the other groups did not have (T. Balot, personal communication, March 24, 2001). In this way, the lower ability students could always participate and contribute something special to the class discussion.

Ideally, only the teacher knew to which ability group she or he assigned a given student. The reason for this was to remove the stigmas that can go with the grouping of students (Stengren, 1958). These ability groups did not need to be the same for every subject (Dickerson, 1958). For instance, a student could be in one group for arithmetic and a different one for English. The teacher could change the student from one group to another during the school year and the student could also request to change groups (S. Ross & Kiester, 1958, and Brentano notes). From interviews with tape teachers, all shared with me that in practice students *did* know to which of the four groups they were assigned.



gure 2. First tape teaching console. St. Scholastica ademy. 1952.

In the fall semester of 1952, a class of primary student first used earphones and tapes in a room with 30 listening booths and six channels of tape (S. M. T. Brentano, O.S.B., 1962, p. 368) (See Figure 2). Brentano believed that providing primary grade children with the best education possible was important since that was where their foundation in education began (M. K. Taylor, OSB, personal communication, January 12, 2000) and she believed that "small pupils were being slighted in their American technological heritage" (Laube, 1958). Figure 2, the oldest dated photograph of tape teaching, requires some explanation. This photograph shows a six-tape console being used by a teacher. When Brentano originally started tape teaching, she used six different tapes. It seems that experience proved that three tapes were as effective as six and required much less preparation for the teacher. The photograph shows high school girls, not elementary school children, in the carrel-style listening booths. Several newspaper articles in the fall of 1954 ("Electronic Classroom," 1954; "Sisters Prepare Tape Recorded Lessons," 1954?; "Tape-recorders, books team up in first U.S. 'Electronic Classroom'," 1954) have photographs that show this classroom being used to teach primary grade girls and boys. Brentano coined the term *Electronic Classroom* to refer to this room since she said it did not seem appropriate to call it a laboratory with first and second graders using it (date unknown).

Brentano's individualized tape teaching innovation evolved with experience. One of the first additions to tape teaching was the use of a worksheet to accompany the tape. As Brentano explained (1962),

> On tape the child never merely listens. He will listen, learn, and on his worksheet record the fruits of his mental activities both for his own help in review and his teacher's evaluation of this achievement....On his worksheet he will likely be asked to write answers that relate the lesson to his past experience, to give the result of his observations, and to carry his observations forward until he can infer from facts some generalization or principle . . . and finally correct his paper by noting the answers which the tape will give him. (p. 369)

Since the six-track individualized tape instruction electronic classroom was popular with both teachers and parents, there was a need to create another tape teaching classroom. The second iteration of the tape classroom was built in 1953 and it provided a less expensive alternative to the original electronic classroom (See Figure 3). In this classroom, conduits that held the lines from the tape recorders extended between the rows of desks. While seated at their desks, the children plugged their earphones into a jack box in the conduit and could listen to the tape without having to be in special listening booths (date unknown).

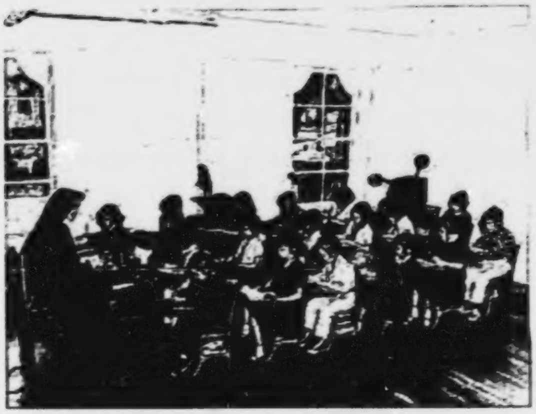


Figure 3. Second iteration of tape teaching classroom. Sister Maris Stella Pravata (Maris Leitz) is the teacher. Date unnknown.

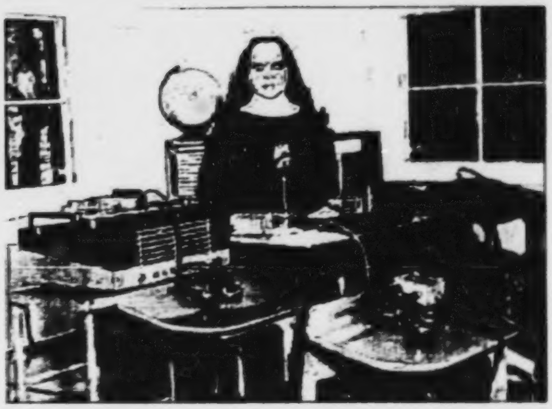


Figure 4. The third iteration of the tape teaching classroom. On Pravata's desk is a microphone and a switch box. Photo by Petit's Studio. Date unknown.

The third iteration of the tape classroom (See Figure 4) developed later involved the addition of an intercom system by which the teacher could contact an individual student without disturbing the rest of the class. Brentano described needing an intercom as a way to get the attention of an inattentive student as well as to determine if a student could properly hear the tape. The first intercom system allowed only one-way communication–from teacher to a student (Laube & Brentano, 1957). Figure 4 shows a tape teaching classroom complete with the microphone by which the teacher could contact individual students. To contact an individual student, the teacher had a set of switches that allowed her tap into the same line as an individual student.

Our Lady of Wisdom Hall–The First Electronic School

The success of tape teaching resulted in an increased enrollment at St. Scholastica Academy. In 1957 to provide more classroom space for the larger enrollment and to meet the needs of Brentano's developing tape teaching innovation, the Benedictine Sisters built Our Lady of Wisdom Hall. *Newsweek* ("Electronic classrooms," 1957, p. 99) referred to Our Lady of Wisdom Hall as "the first structure in the history of American education to be specially designed and pre-wired for electronic teaching." Our Lady of Wisdom Hall, a one-story, air-conditioned, three-classroom building, cost $75,000 of which $15,000 was for the electrical features ("Classroom electron," unknown). Two classrooms, that Brentano called Classroom Electron I, were somewhat traditional looking with individual desks and the other classroom, Classroom Electron II, had 32 individual recitation booths as well as desks. There was a fourth and much smaller room called the individual measurement room.

Classroom Electron I

At first glance, each of the two identical Classroom Electron I's looked like traditional classrooms (see Figure 5). One noticeable difference is that on the floor beside each desk is a recessed receptacle into which a student plugged in a set of earphones. This innovation, designed by Brentano, eliminated the raised conduits with wires in the aisles between the students' desks. The second special feature was that the teacher's desk was replaced by a special six-foot long console that includes four heavy-duty Viking-75 tape recorders ("Electronic age school," 1959), a set of control switches for each student's desk, and a headset with a microphone for the teacher (see Figure 6). The four reel-to-reel audio tape players allowed the teacher to present up to four different taped lessons at any given time. Besides the three tapes used for instructing three different ability groups, the fourth tape recorder was available for a variety of purposes: a special lesson for highly accelerated students, a remedial lesson, a make-up lesson replaying a tape missed a previous day, or as a replacement tape recorder if one of the other three recorders was not working correctly. The toggle switches shown in Figure 6 allowed the teacher to select which of the four tapes each individual student heard.

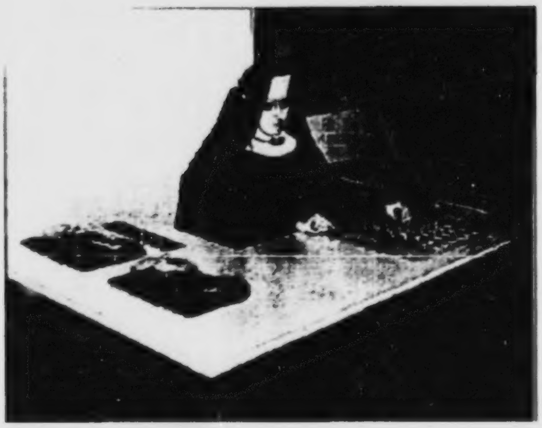


Figure 5. Classroom Electron I. While Pravata instructs some students others are using earphones for taped instruction. Photo by Petit's Studio. 1957.

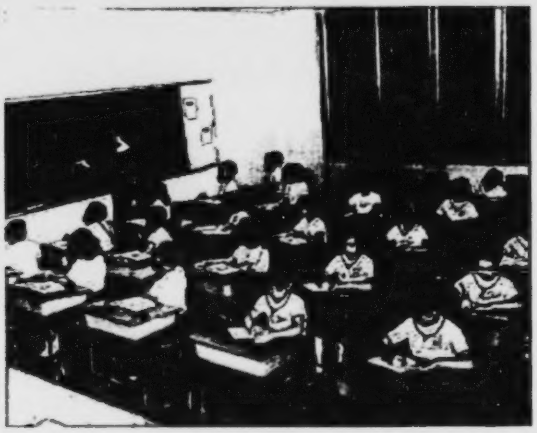


Figure 6. Classroom Electron I teacher's console. Sister Anthony Balot (Toni) adjusts the switches to set which tape a student hears. Photo by Petit's Studio. 1957.

Clasroomsroom Electron II (or the Booth Room)

The single Classroom Electron II (or Booth Room) in Our Lady of Wisdom Hall was equipped with desks in the middle of the room and a total of 32 soundproof individual recitation booths along twosides of the room (see Figure 7). The desks permit the teacher to work with a small group of students while the other students are working in their own recitation booths. Each booth had a writing shelf, one or more chairs, a set of lightweight, removable earphones, a two-way intercom speaker, and a light. In each booth there are four possible openings into which to plug the earphones. This allowed the teacher to select audio from one of the three tapes, a record on the phonograph, or a radio program depending on what she or he wanted the student to hear. A switch in each booth allowed the student to contact the teacher by turning on a light on the annunciator panel on the teacher's console (see Figure 8). The teacher, through the use of her headset at the console, could answer the student's question privately without disturbing anyone else. The use of the headset also allowed the teacher to listen in on what was going on in any of the booths without disturbing the student ("$40,000 Ford grant enables college to test new electronic teaching system," 1958; Sherman, 1958).

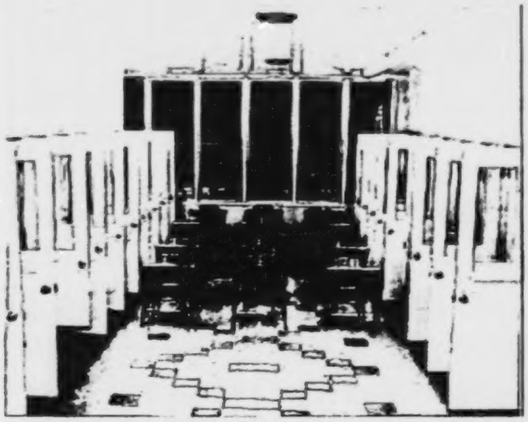


Figure 7. Classroom electron II. Photo by Petit's Studio. 1957

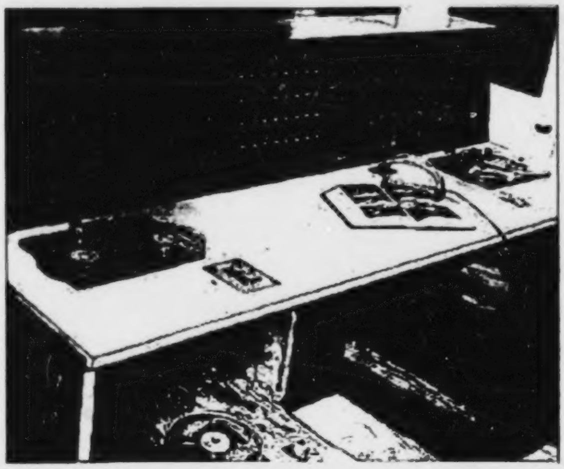


Figure 8. Classroom Electron II teacher's console complete with 3 tape recorders, record player, annunciator lights Switches for each of the 32 booths and teacher's headset.

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Stoma (1957) reports that there was an individual measurement room in Our Lady of Wisdom Hall where the teachers posted records of each student's progress and of each class's achievements. The original plan was that this small room would be used as a research laboratory in which the teachers could study how a child actually learns. From what I could ascertain from conversations with former tape teachers and from Brentano's notes, the individual measurement room was never used for anything other than a place to post test results. It is likely that the primary reason for this is lack of development of the individual measurement room is that Brentano returned to Atchison, Kansas, at then end of August 1957, only months after Our Lady of Wisdom Hall opened.

1957 Summer Tape Workshop

Late in May of 1957, the Ford Foundation Fund for the Advancement of Education awarded Brentano $15,000 to conduct a six-week Tape Workshop in Our Lady of Wisdom Hall during the summer of 1957 (Fine, 1957). At the workshop, Brentano taught teachers how to implement her tape teaching methods in their own classrooms including how to write scripts, record tapes, and make worksheets. A total of 36 teachers, all members of Catholic religious communities, attended the workshop and made tapes in geography.

The Tape Institute at Mount St. Scholastica

In August 1957, Brentano returned to her home religious community of Mount St. Scholastica in Atchison, Kansas, to set up and run the Tape Institute. With more than $100,000 in grants from the Fund for the Advancement of Education over a three-year period, $23,000 from the Raskob Foundation for Catholic Activities, Inc., and with space and financial assistance from Mount St. Scholastica College, the Tape Institute was the center of Brentano's tape teaching innovation until the mid 1960s. The Tape Institute was responsible for creating more than twelve thousand tapes, scripts, and worksheets in all different subjects for all grades and distributing them to schools using Brentano's methods around the country. Most of these tapes were created by the teachers who attended the four summer tape workshops from 1958 to 1961. The Tape Institute was also responsible for coordinating the standardized testing done in tape schools and their counterpart non-tape schools to provide for statistical measures of the success of tape teaching.

By 1957 the following schools had adopted Brentano's individualized tape teaching methods:

- St. Scholastica Academy, Covington, LA: 5th through 8th grades
- Mater Dolorosa School, New Orleans, LA: 2nd grade, remedial reading
- Cathedral School, Lafayette, LA: 8th grade
- De La Salle Normal School and Junior Novitiate of Brothers of the Christian Schools, Lafayette, LA: social studies and chemistry
- Our Lady of Fatima School, Lafayette, LA: 6th grade
- Immaculate Conception School, Grand Prairie, TX: 4th grade, reading clinic
- Incarnate Word School, San Antonio, TX: 1st grade
- St. Joseph Cathedral School, St. Joseph, MO: 3rd and 6th grades

In 1958 there were 45 rooms in 16 schools using Brentano's tape teaching methods and by 1960 there were electronic classrooms in 80 schools (Keating, 1961, p. 20).

The Benefits of Tape Teaching

According to Brentano (1962, p. 369), there were four main benefits for students taught using individualized tape teaching. The first benefit was that tape teaching fits student's needs because the students listened to tapes especially made for their ability level. If a student needed special attention, then the teacher provided that while the rest of the class listened to tapes.

A second benefit was that tape teaching presented superior instruction since it was the goal of the teacher making the tape "to present the best material in the best way, so that the pupils who learn it will be equipped to live successfully in their world" (Knoedel, 1958). Tapes were not merely to repeat a textbook, but were to be creative, interesting, up-to-date works of art worthy of keeping and using again and for sharing with other teachers.

The third benefit of tape teaching was that students learned to concentrate better. According to Brentano, one reason for improved concentration is that the use of earphones created a feeling of a more personal contract with the teacher. "The hearing of a lesson on earphones is a much more intimate experience than hearing a tape played aloud. With this information going into the student's ears, and his eyes occupied with the worksheet, the attention is truly phenomenal" (personal notes of Brentano). Directions were given at the beginning of the tape. Since the tape did not repeat directions, students soon learned that if they missed the directions, they were out of luck since the teacher would be busy instructing another group and could not be interrupted. Throughout the tape, the student had to listen carefully in order to answer questions on the worksheet. At the end of the tape, answers to the worksheet were given and the student had to continue to pay careful attention to make sure s/he graded the worksheet properly.

The fourth benefit Brentano (1962, p. 369) listed for tape teaching is that it allowed the student to have more personal contact with the teacher. A former tape student told me that when she listened to a tape, she felt like the teacher was talking directly to her. Brentano claimed that tape teaching multiplied a teacher's voice and personality since she or he was really teaching four classes at a time–not just one. This allowed teachers "*more* time for discussion, *more* time for questions, *more* time for individual help" (emphasis original) (S. Ross & Kiester, 1958). Brentano strongly believed that tapes were not meant to replace a teacher, but were meant to supplement her by multiplying her presence in the classroom (M. T. Brentano, O.S.B., 1959; Keating, 1961; "Tape-recorders, books team up in first U. S. 'Electronic Classroom'," 1954; "What is a tape-teaching workshop?," unknown).

Tape teaching often produced impressive test results. For instance, of the 100 elementary students at St. Scholastica Academy who were taught using Brentano's tape teaching methods during the 1956-57 school year, only one student failed to average the ten-month expected gain on the Metropolitan Test. "Twenty-five averaged a gain between one and two years; fifty-five averaged a gain between two and three years; eighteen a gain between three and four years, while one surpassed the equivalent of four years' gain as measured by standard norms" (Laube, 1958, p. 13).

Some Problems and Challenges of Tape Teaching

As with all innovations in educational technology, tape teaching had its share of challenges and problems. In this section I briefly describe many of these challenges. One problem with implementing tape teaching was the cost of setting up an electronic classroom, the ongoing cost of maintaining it, and the cost of paper for worksheets. In 1958, Brentano estimated that a school could equip a classroom for tape teaching for $3000 (B. Ross & Ross, 1959). If the funds were available, a major problem was finding an electrician who could build and wire the specialized console since these were not available commercially. Tape teachers often shared with me that equipment did not work properly, i.e., tape recorders broke frequently, students couldn't hear with their earphones, headsets picked up radio programs rather than the tapes, etc. The quality of the recordings often made it hard to hear and understand a lesson.

Although tape teaching was supposed to give the teacher more time, tape teachers in the first years of the innovation found this to be anything but true. Since there were no scripts, tapes, or worksheets, the classroom teacher had to do all this herself/himself besides the usual classroom responsibilities. To research and write the kind of creative script that Brentano expected could take 20 or more hours. Another problem was that when a trained tape teacher left a school there was often no one trained to use tapes to replace her/him. The loss of the trained tape teacher often meant that tapes were no longer used or were not used as Brentano intended.

Brentano's intent was to have the Tape Institute create an entire tape curriculum for all elementary subjects, but this never came to pass. From what I can tell from my research, it seems that the Tape Institute never made an entire year's set of tapes for any subject for any grade. Most of the creative, artistic tapes produced by teachers for the Tape Institute were not correlated to specific textbooks. Teachers using tapes obtained from the Tape Institute had to figure out where in their own curriculum to use a tape or set of tapes. For instance, tapes that a teacher created for her/his fifth grade social studies class in Kansas may not fit with a similar class in Kentucky. Tapes also became outdated rapidly and required a teacher to update and re-record a new tape.

Since tape teaching was first implemented in Catholic schools, the press and others raised questions as to whether tape teaching could be as effective in public schools as it was in Catholic schools. An article in *The New York Times* (Fine, 1957, p. 47) asked, "Can this program operate as effectively in a typical public school, with large classes and overworked teachers?" Another problem that kept tape teaching from becoming more widespread in public schools was the Catholic content of many tapes. Most of the participants at the summer tape workshops were members of Catholic religious communities who taught in Catholic schools. As they would when teaching in their own classroom, the scripts they wrote contained numerous references to things Catholic although these were not scripts for religion class tapes. For instance, a script for a tape for first grade science began with, "Today, boys and girls, we are going to talk about this big, wide, wonderful world that God made for us." The Catholic content of tapes was problematic when Brentano sold the tapes.

Brentano had little assistance in running the Tape Institute. It seems that she had someone available to multilith the worksheets and at times had part time secretarial help. From several letters written to Brentano from tape teachers, it seems that she sometimes had a hard time getting the correct tapes, scripts, and worksheets mailed to teachers in a timely manner.

In some ways Brentano may have been counter-productive in carrying on her own tape teaching innovation. For instance, her attitude was that all tapes were always unfinished. This attitude meant that Brentano was always in the process of revising and updating tapes. Brentano was not a practical, detail person, but a dreamer and a visionary. Once she had experimented with tape teaching and saw that it could be successful, Brentano moved on to explore her other creative ideas. As early as 1958, she started working on a Thinking Curriculum that used audio tapes and worksheets to teach thinking skills to children in elementary school. The Thinking Curriculum grew to involve the study of the importance of color in teaching and how to teach logic to elementary school children.

The End of Tape Teaching

With the increasing availability and popularity of video technologies in education and computer-aided instruction plus Brentano's shift to other interests, tape teaching soon became history. By 1962, there were no longer articles in newspapers or magazines about her tape teaching methods and by the middle 1960s, there was very little correspondence to Brentano regarding tape teaching. In 1970 Brentano entered into a contract with Scott Scientific, Inc. of Fort Collins, Colorado, to sell them the tapes, scripts, worksheets, reel-to-reel tape recorders, and other equipment with the hope that they could successfully market them. Despite the best efforts of Scott Scientific, including removing the references to God and things Catholic, re-voicing the tapes, copying them onto cassettes, and creating ditto masters of the worksheets, by 1971 Scott was no longer able to sell any of her tapes and Brentano's tapes were eventually returned to her (A. Spring, personal communication, April 29, 2000).

Importance of This Research for the Field of Educational Technology

My research provides several interesting results for the field of educational technology. Due to space considerations, I discuss two of these in this paper. Besides making known an overlooked innovation in the field, my research provides a comprehensive look at an innovation in educational technology from its initial idea to its conclusion. I have extensive documents from Brentano including personal correspondence and even some reel-to-reel tapes that she made describing tape teaching and its history. Interviews with the first two tape teachers from St. Scholastica Academy, with several tape teachers involved during the height of tape teaching, and with some who used tapes during its waning years of use provide a fascinating look at the life cycle of an innovation. Personal communication with friends and associates of Brentano during the tape teaching years supply a wealth of knowledge and insights about what it was like for Brentano as an innovator in educational technology during the 1950s and 1960s. My dissertation, *Sister Mary Theresa Brentano, O.S.B.: Innovator in the Use of Magnetic Audio Tapes–An Overlooked Story in the History of Educational Technology* (Herndon, O.S.B., 2002 (anticipated)), provides a more thorough documentation of Brentano's innovation than is possible here.

The second implication of my research concerns why official histories of educational technology have overlooked Brentano's individualized tape teaching innovation. I believe there are several possible reasons for this oversight. Brentano's work was featured in more than thirty newspaper and magazine articles including *The New York Times* (Fine, 1957) and *Newsweek* ("Electronic classrooms," 1957). The United States Information Agency ("USIA television service films electronic classroom," 1959) produced a five-minute movie clip illustrating Brentano's tape teaching innovation. Upon her death, *The New York Times* ("Nun Who Pioneered the Use of Electronic Teaching Dies," 1987) printed her obituary. One might guess that her place in the history of educational technology was assured. However, the popular press is not usually a place where academics look when writing the history of the field. For instance, De Vaney and Butler in "Voices of the Founders: Early Discourses in Educational Technology" (1996) used information from audiovisual textbooks and oral history audiotapes from the Archives of the Department of Audio-Visual Instruction. Brentano did not write a textbook about individualized tape teaching and the reel-to-reel oral tapes that Brentano herself made have been stored in the Mount St. Scholastica Archives unknown to anyone at all until this research.

The data that I have does not suggest that Brentano belonged to any professional organizations. One can only guess that Brentano may have believed that she did not have time or that she had no need for any type of professional affiliation. She did speak at many regional professional meetings and also two national conferences: the Catholic Audio-Visual Association Conference in 1954 and the Department of Audiovisual Instruction Convention in 1962. The only professional publication of her work is the text of her presentation from the latter convention published in *Audiovisual Instruction* (S. M. T. Brentano, O.S.B., 1962). One might guess that women religious were not permitted or encouraged to hold membership in professional organizations or to publish scholarly papers during the 1950s and early 1960s, but that was not so at Mount St. Scholastica. During this time period, several sisters were actively involved in professional organizations and in publishing scholarly research.[5]

Other reasons could also have contributed to Brentano's work being overlooked in official histories of the field of educational technology. Very little is written in any book regarding the use of audio tapes in the classroom, including Saettler's (1990) definitive history of the field, *The Evolution of American Educational Technology*. Brentano's original work with audio tape teaching was not based at a major research university, but at a small Catholic K-12 school. When she did move her base of operation to be associated with a college, it was to Mount St. Scholastica College, a very small Catholic women's college in Atchison, Kansas. Although this does not outwardly appear to be a concern to Brentano, this move was not helpful in making her work known in academic circles. De Vaney and Butler (1996) state that, "Historically, although women in audiovisual education played major roles, they were often overlooked and/or assigned minor ones" (p. 39). One can speculate that the fact that Brentano was a woman and was a member of a Catholic monastery were also reasons in their own way for her being overlooked in official histories of the field.

Conclusion

This paper presented an overview of Sister Mary Theresa Brentano's innovation in educational technology–the use of magnetic audio tapes to provide individualized instruction to children in K-12 schools. I described Our Lady of Wisdom Hall at St. Scholastica Academy, Covington, Louisiana, the first school designed and built for electronic teaching with its two different types of Classroom Electron. Benefits of tape teaching were recounted along with some challenges and problems involved with the innovation. Lastly, I presented two contributions this research contributes to the field of educational technology: a complete history of an innovation in educational technology from its beginning to its end and some reasons how an innovation such as this can be overlooked in the official histories of the field.

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Build It and They Will Stay: A Research-Based Model for Creating Community in Web-based Learning Environments

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Abstract

The purpose of this study was to explore best practices for community building in Web-based learning environments. The study took place in two Web-based courses at two universities. An embedded case study design was used, and multiple sources of evidence (e.g., chat and bulletin board transcripts, interviews, and surveys) were gathered to inform the results. Overall, participants in both courses indicated some sense of community, albeit limited in scope (i.e., the learners indicated a stronger connection with their team members than with the larger class group). While more research is needed, our study indicates that enabling and encouraging the use of these strategies and techniques may contribute to the long-term viability and use of WBI in institutions of higher education.

Introduction

The use of electronic technologies for the delivery of instruction has grown at an exponential rate over the last five years. Institutions of higher education, corporations and K-12 environments continue to seek ways to use on-line tools to deliver instruction. Concurrently, the technological infrastructure is expanding in terms of its capabilities and power (Daniel, 1998; Katz, 1999), increasing learner access to the technologies needed to acquire and share information with other participants. This convergence in interest by educators and learners in learning via distance technologies has enabled an exponential increase in the quantity of distance courses and programs across disciplines (e.g., art, history, information systems, education, science) and contexts (Otchet, 1998).

While the increased interest and need is an exciting development, several challenges associated with the successful implementation of Web-based instruction (WBI) remain unresolved, including retention and high dropout rates (see Barley, 1999; and Hill, in press, for an overview of several issues). Retention has historically presented challenges for distance educators. According to Moore & Kearsley (1996), dropout rates have ranged from 30 - 50%. While this figure is inclusive of a variety of distance learning technologies (video, print, etc.) and the authors point out that the dropout rate would now be at the lower end, 30% is still a considerable percentage to lose in a learning experience. WBI, with its high demands psychologically and technically, makes this challenge even more significant.

Several factors may contribute to retention challenges in distance education. Factors mentioned in the literature include: lack of prior experience with distance learning, external demands, and conflicts with motivation demands (external vs. internal) (see, for example, Carr, 2000). Another explanation for high dropout rates and dissatisfaction with distance delivered courses may relate to a lack of a perception of community in courses that are not face-to-face. Students may feel like they are isolated, creating an experience of lack of presence from others involved in the course.

Perception of a community may assist learners with feeling connected or belonging (Halaby, 2000; Joyce & Weil, 1996). Research in on-line environments indicates that community building can occur in distance delivered courses (Hill, 1999a; Palloff & Pratt, 1999), much like community building can occur in virtual teams in the business sector (Lave & Wenger, 1991; Raven, 1999). Given that a sense of a community has been demonstrated to contribute to group performance within a corporate context (Lave & Wenger, 1991), it may prove to be a benefit in a learning context. Discovering the best strategies and techniques for community building may lead to enhanced course outcomes (e.g., retention, satisfaction, learning outcomes) by participants in WBI.

Purpose

The purpose of this study was to explore best practices for community building in WBI. In doing so, the study sought to examine specific strategies and techniques designed to facilitate the establishment of an on-line community. The study was guided by the following general research question:

What are the best techniques/strategies to enable community building in WBI?

This question was addressed through a number of sub-questions, two of which will be focused upon in this paper:

- What can we do, as designers of, and instructors in, a WBLE to assist the learner in the effective building of community while learning in a Web-based environment?

- What strategies can learners use to assist themselves (individually and with each other) in community building while engaged in learning in Web-based environments?

Significance of the Study

While considerable research has been conducted in the general area of distance learning, research specific to Web-based environments for learning has only recently been published (see, for example, Dehoney & Reeves, 1999; Khan, 1997; Hill, 1997a; Hill, 1999a; Owston, 1997; Pritchard, 1998), and most is being presented at a theoretical rather than an empirical level. As the Web and Internet-based technologies (e.g., bulletin boards, email, CUSeeMe, streaming video, instant messaging) continue to grow in popularity and use in higher education, we felt that institutions would benefit greatly from investigation of best practices related to WBI, in our case, specifically examining best practices for community building.

Interest in building community is certainly not new, nor is it something isolated to study in the context of higher education. Lave and Wenger (1991) have spent considerable time examining the issues related to forming community in a business and industry setting. Joyce and Weil (1996) called for the creation of a communities of professional educators within a school setting. Halaby (2000) brings the notion of belonging into the classroom setting, emphasizing a need to help students belong. More recently, Palloff and Pratt (2001) extended their work on community building within higher education settings, focusing on providing hints and tips for the online teacher.

Certainly, this work is useful and adds to our literature base. However, much of the work completed to date is primarily theoretical, and while based in experience, is not primarily driven by empirical research. Further, the current work does not define specific models for how to enable community-building in a Web-based environment -- both from the teacher and student perspective. We need data-driven strategies and models, presenting techniques on both sides of the desk, so that others can test the robustness of the models in a variety of environments.

Research Plan

Research Design

An embedded case study design was used for this study, involving the use of multiple cases, or embedded units, within a larger context. The unit of study in the case was the individual faculty member or student involved in the WBI implementation. Multiple sources of evidence were used to triangulate the data, thus addressing possible concerns with internal validity (Yin, 1994). This approach has been used by one of the researchers in previous research (Hill & Hannafin, 1997; Hill, 1997b), and has proven successful when looking to describe rich contexts, and for model development (Hill, 1999b).

Selection and Description of the Participants

Two groups of participants were engaged in this study. One consisted of a an instructor and students involved in the Master's level course Information Technology Infrastructures in a college of business at a university in a large metropolitan area. The other consisted of an instructor and Master's level students involved in the course Instructional Design in a college of education at a university in a rural area. The population included university instructors, instructional design experts and working professionals returning to school from various sectors of business and industry (e.g., information technology management, technical support, Web development) and education (K-12 and higher education).

The courses were selected for two primary reasons:

- Involvement in the courses was voluntary. Although for many students the courses were required for completion of the degrees, they decided when and how to take the course. Most students enter with a high level of interest and motivation.
- Learners begin the course with a variety of backgrounds, as well as differences in their technology experience. This variety is essential for examining strategies and techniques across potential students.

Two groups comprised the sample of this study:

- university faculty as subject matter experts to help inform the design, development, and implementation of the courses; and
- students enrolled in the courses during summer term.

WBI Development

Measures and Instrumentation

A combination of positivistic and interpretivist techniques were used in gathering evidence for the study. Various instruments were used to facilitate data collection for the study: surveys, interviews, observations, and content analysis of discussion transcripts. Positivistic techniques were used to generate individual difference measures for each case. Interpretivist techniques were used to monitor the use of community-building strategies and techniques.

Settings and Procedures

Implementation of the courses took place over a 7-8 week period during the summer of 2000. Data were collected in a variety of environments. Pilot testing with learners in the spring and data gathering with learners in the summer took place in the environment in which the WBI was used, including campus computer labs and the learners' homes/places of employment (depending on where they have access to the Web). A combination of questionnaires, observations, interviews, and content analysis of transcripts from on-line discussions were used to gather data from students. The facilities and necessary equipment for data gathering were fully established at each institution.

Analysis

To the extent possible, the collection, organization, and initial analysis of data occurred concurrently. Previous research indicates that this assists with indicating gaps in data as they are gathered and allow for adaptations in the process (e.g., need for additional information) (Glaser & Strauss, 1967; Hert, 1992; Hill & Hannafin, 1997). One "gap" that did occur related to the number of participants. We did experience a reduction in participants in both courses, with the final number of participants being 21 in the Information Technology Infrastructures course and 22 participants in the Instructional Design course.

In-depth data analysis took place throughout the academic year following the offering of the courses. One level of in-depth analysis involved reading through and coding the transcripts from the online chat and bulletin board discussions. As the researchers read the data, pre-established codes were used to mark-up the data (Ericsson & Simon, 1984; Hill & Hannafin, 1997). Additional codes were established as themes and patterns not readily applicable to the established categories emerged.

Another level of in-depth analysis involved chunking sections of the data related to specific research questions according to pre-established strategies and techniques for community building (Hill, 1999b). Pattern matching was used to inform the generation of an overall list of strategies and techniques -- instructor and student -- for community building in WBI, enabling the creation of a theoretical model for community-building in WBI. These coding and analysis techniques have been documented in the literature (Bogdan & Biklen, 1992; Krathwohl, 1998; Yin, 1994) and were used by the researchers in previous studies (Hill, 1997b; Hill & Hannafin, 1997).

Data Presentation

The content of each student's and instructor's posting was analyzed to determine the number and type of constructs was examined. Thirteen constructs in participants' posting were identified: active interaction, socially constructed meaning, expressions of support and encouragement, collaborative learning, sharing information, acknowledgement of others, chitchat, teacher initiative, student initiative, teacher response, student response, student evaluation, and teacher evaluation.

To help inform the results, the data were first divided into two main categories: infrastructure strategies and interaction strategies. Codes and definitions for strategies included in these categories are displayed in Table 1.

Codes	Constructs	Definition
AI	Active Interaction	Involving both course content and personal communication; purposeful, engaged, energetic
SCM	Socially Constructed Meaning	Agreement or questioning with the intent to achieve agreement on issues of meaning
ESE	Expressions of Support and Encouragement	Encouraging comments to their classmates. Exchanged between students.
CL	Collaborative Learning	Sharing ideas and knowledge among students. Comments directed primarily student to student rather than student to instructor
SI	SharingInformation/Resources	Among students (resources = container) Integration of people, resources
ACK	Acknowledgement of others	Noting presence of person
CC	Chit Chat	Social interactions not related to class

Table 1. Codes for infrastructure strategies

We also divided the interaction strategies categories (data) into two other categories: instructor strategies and student strategies. Codes and definitions for strategies included in these categories are displayed in Tables 2 and 3.

Codes	Constructs	Definition
TI	Teacher Initiative	Asking question to lead and facilitate the discussion
TR	Teacher Response	Answering questions to respond to student
TE	Teacher Evaluation	Teacher evaluation about student response

Table 2. Codes for interaction strategies – instructor strategies

Codes	Constructs	Definition
TI	Teacher Initiative	Asking question to lead and facilitate the discussion
SI	Student Initiative	Asking question to negotiate or clarify the source and extent of disagreement
TR	Teacher Response	Answering questions to respond to student
SR	Student Response	Answering questions to respond to teacher
SE	Student Evaluation	Willingness to critically evaluate work of others
TE	Teacher Evaluation	Teacher evaluation about student response

Table 3. Codes for interaction strategies – student strategies

We also analyzed the data from a qualitative perspective, seeking to understand how events occurred overtime. Figures 1 and 2 exemplify the graphs we made to help inform this level of analysis.

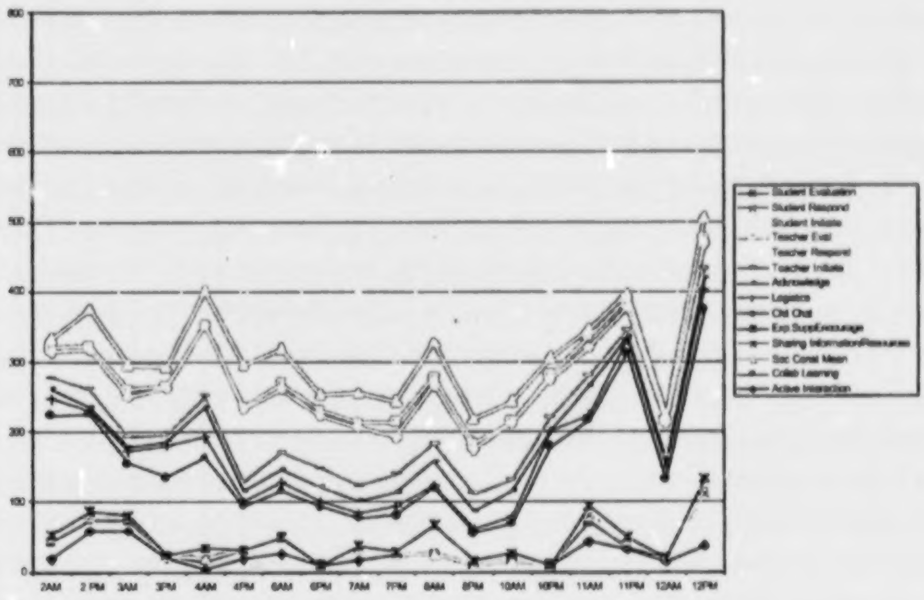

Figure 1. Coding of all chat sesions for the Information Infrastructures course

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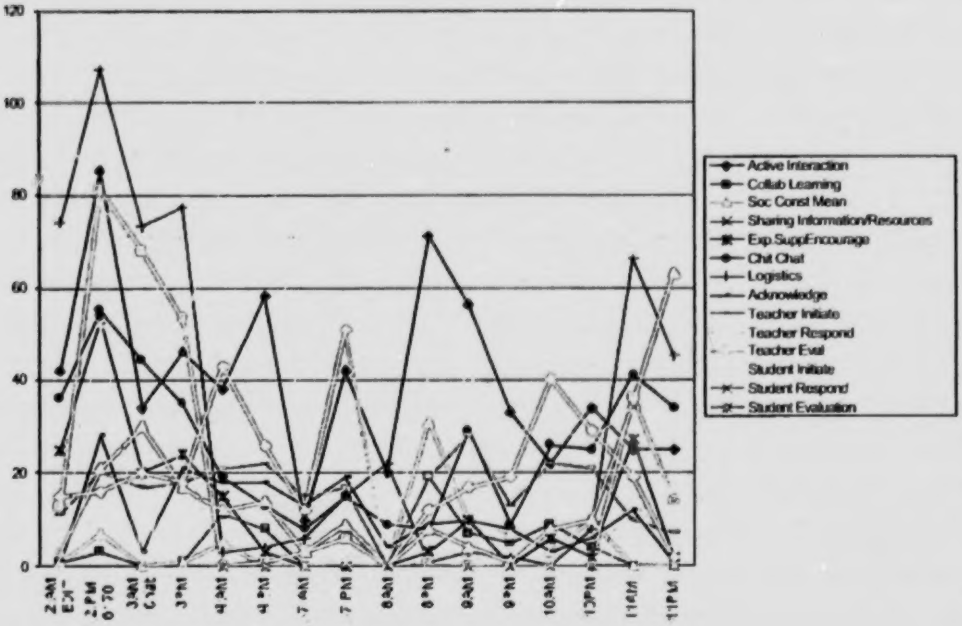

Figure 2. Coding of all chat sesions for the Instructional Design course

After coding of the transcripts was complete and initial patterns were emerging, the researchers then looked at other data sources as points of triangulation of the findings. Focus group interview notes were reviewed; end of term surveys were analyzed. Trends in these data were then compared to the trends and patterns established from the discussion transcripts. Strategies and techniques were adjusted as needed based on the data.

Findings and Results

Analysis of the data was an intensive task, cognitively and logistically. Many hours were spent by the researchers, individually and as a team, reviewing and refining our findings. The results of our efforts are presented below, organized according to our research questions.

What can we do, as designers of, and instructors in, a WBLE to assist the learner in the effective building of community while learning in a Web-based environment?

Based on feedback from the learners during implementation, as well as expert review of the course, there are several things that designers and instructors can do during the design, development and implementation stages to help with community building in WBI.

One strategy that proved very effective was ensuring that learners have sufficient opportunities to interact with each other as well as with the instructor. Our research indicates that learners want a variety of ways to interact with each other. Learners in the Information Infrastructures course and the Instructional Design course indicated that all of the communication technologies (e.g., chat, bulletin boards, email, phone) were working well and were important for facilitating interactions.

Another strategy used in the Instructional Design course that proved effective was the use of CSM messages. CSM messages indicated to learners what they Could be doing, what they Should be doing, and what they Must be doing. These messages were sent out by the instructor once or twice a week to remind learners of tasks for the week. During the mid-term evaluation, learners indicated that the CSM messages were important not only for keeping them on track, but also for letting them know that the instructor was there.

Yet another strategy that proved effective for community building was the use of teams for completing work. In the Information Infrastructures course, teams of 2-4 worked together; in the Instructional Design course, teams of 2 worked together (i.e., Design Buddies). In both instances, the learners indicated that the team members contributed very positively to their sense of belonging and a sense of connection with others in the course.

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There were also several strategies built into the structure of the Web sites to assist with community building. These included: access to multiple communication technologies, posting of announcements and "what's new" updates, and personal Web pages for each learner that included a picture and biographical information. All of these approaches appear to have contributed to the ability of a community to form as the learners interacted within, and used, the WBI environment for learning.

What strategies can learners use to assist themselves (individually and with each other) in community building while engaged in learning in Web-based environments?

Analysis of surveys, as well as transcripts from various interactions in the courses, indicate that several strategies were used by learners to assist themselves with community building and learning in a WBI environment. A strategy used by several learners was a daily visit to the Web site to check for new messages on the bulletin boards. While many learners indicated that this was frustrating ("takes too much time"), others stated that the frequent visits helped them with establishing a sense of belonging to the course.

Two other closely related community building strategies used by learners are encouragement and support. Evidence of this was seen throughout bulletin board postings, chat room interactions and e-mail messages between team members/Design Buddies as well as between WBI participants in general.

Several learners indicated that the experience was somewhat overwhelming. This comment related mainly to the number of messages learners had to read on bulletin boards, in chat sessions and in e-mail. One strategy mentioned by several learners was that of scanning; that is, reading for content not for detail, in order to keep the information exchange manageable.

What are the best techniques/strategies to enhance community building in WBI?

Overall, several strategies and techniques for community building in WBI emerged from the initial analysis. The strategies and techniques, compiled across those discussed in the research sub-questions, have been divided into two main areas: infrastructure and interactions (see Table 4).

Infrastructure Strategies	**Interaction Strategies**
Access to multiple communication technologies.	Read for content not for detail.
Posting of announcements and "what's new" updates.	Encourage and support fellow learners in their efforts.
Personal Web pages for each learner.	Use CSM messages to indicate to learners what they Could be doing, what they Should be doing, and what they Must be doing in terms of the course.
Learners have sufficient opportunities to interact with each other as well as with the instructor.	Use of teams for completing work in the course.
	A daily visit to the Web site to check for new messages on the bulletin boards.

Table 4. Strategies and techniques for community building in on-line environments.

Infrastructure strategies are the responsibility of the instructor. They create the environment that enables or inhibits the formation of community. Interaction strategies take place during the class, they involve actions from both the students and the instructor/facilitator.

We have also represented the strategies in terms of target audience, i.e., instructor or learner (see Table 5).

Instructor Strategies	**Learner Strategies**
Provide multiple opportunities for interaction.	Visit the course Web site daily (or every other day at a minimun).
Send out management related messages (e.g., CSMs) on a regular basis.	Provide encouragement and support.
Establish teams so that learners work together to complete tasks	Scan material posted on the Web site - do not read for detail.
Keep the Web site up-to-date and add in new information on a regular basis to keep things "fresh."	

Table 5. Instructor and Learner Strategies for community building in on-line environments.

Community Building: A Process-based Model

It would appear that some level of community building did occur in both the Information Infrastructures and the Instructional Design courses. Specifically, by looking at graphs of the interaction data (as recorded in the bulletin board and chat transcripts (see examples in Figures 1 and 2)), we see evidence that community was established over time and that there were certain points in the term where participants were "closer" in terms of a community than others.

The analysis completed to date has enabled the creation of the beginnings of a theoretical model for community building and its potential relationship to learning (see Figure 3). While the model is not complete, it does exemplify a significant step toward identification of strategies and techniques that can enable the creation of community in WBI.

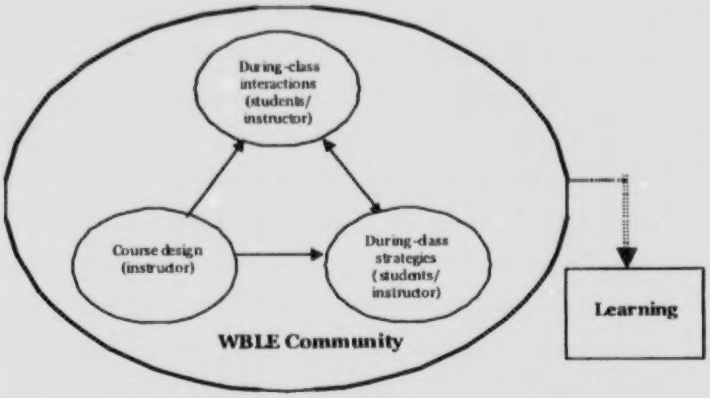
During-class interactions (students/ instructor)
Course design (instructor)
During-class strategies (students/ instructor)
WBLE Community
Learning

Figure 3. Creating Community for Learning

The model in Figure 3 illustrates how community building strategies may lead to community building activities that take place during a class, which leads to the existence of community. The existence of community is predicted to result to higher levels of learning. This learning can be measured through the coding of instances of socially constructed meaning, and collaborative learning.

As discussed earlier, in the design phase of a course, the instructor can implement a number of strategies that provide a basic infrastructure for community building. During the class, both instructor and students can use interaction strategies for community building. The two sets of strategies lead to interactions during the class, again by students and instructor, and these interactions lead to the emergence of a community.

Discussion & Suggested Next Steps

This study investigated strategies and techniques for community building in WBI. Overall, participants in both courses indicated some sense of community, albeit limited in scope (i.e., the learners indicated a stronger connection with their team members than with the larger class group). While more research is needed, our study indicates that enabling and encouraging the use of these strategies and techniques may contribute to the long-term viability and use of WBI in institutions of higher education.

As we continue work in this area, we are also beginning to consider different questions and issues to explore. One issue we offer as an area for additional study is that of adjustments to change. As compared to face to face classes, WBI courses place more demands on both instructor and students in terms of amount of time worked, and number of student-instructor and student-student interactions. As with regular face to face classes, it is better to wait with the evaluation of a WBI course until it has been taught at least twice. The first time around is typically a learning experience for the instructor and the learner; better to use this as a vehicle to determine what works and what doesn't, and then make additional judgments the second -- or third -- time around.

We also recognize the need for assisting others in the implementation of community building strategies in their own WBI experiences. Models and tools to assist with this effort would go a long way toward helping others interesting in building community in their own WBI. We are currently developing a model for community building in WBLEs, and encourage others to also explore this area.

Conclusion

By delivering engaging and meaningful instruction in WBI environments, the university can increase its visibility and viability in the 21st century educational arena. Further, results from this study can be used to guide and facilitate the design, development, and implementation of WBI to increase interaction and engagement. This, in turn, can potentially lead to higher retention (our experience: 94%) and satisfaction (our experience: high) in on-line courses at institutions of higher education.

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Learning in Action: The Professional Preparation of Instructional Designers

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Abstract

This was a case study analysis of instructional designers and their preparation for professional practice. Seven instructional designers were selected to participate in this study based on the following criteria: employment at a company developing instructional materials for external clients, three to five years experience, and attendance at a graduate program of instructional design or technology.

Each participant was interviewed on two occasions using a semi-structured interview format. Case studies were presented on the analysis of the interviews and quotes were used to accurately express the perceptions and feelings of each participant. The cross-case analysis identified major themes, which emerged from the interviews.

Individual differences as well as common perspectives on preparation and professional practice were noted between the participants. This study confirmed prior research into the preparation of instructional designers for professional practice. The theoretical body of knowledge as well as the practical knowledge and competencies used to solve problems in a variety of environments define this practice. This research identified three profiles of instructional design practice that correlate with the expert-novice continuum: Innovator, Traditionalist, and Practitioner. This study also identified instructional designers' perceptions of effective graduate preparation for instructional design. Recommendations for instructional technology programs and for future research are provided.

Background

Instructional Design: Science and art. A blank canvas and a variety of paintbrushes and pigments are merely tools; the paintbrushes form textures and the pigment color. Their potential to become a work of art lies in the artist's knowledge about materials and composition, intuition and creativity. Applied to the canvas, textures form layers that the artist explores and adapts into shapes and meanings until, like pieces of a puzzle, they fall into place and form a personal message. Instructional Design (ID) practice is also both science and art. Its blank canvas is an organization's need or learning opportunity and the potential for an effective solution. Just as the painter's tools fill a canvas with texture and color, a multitude of systematic models outline the ID process and methods adapted from a variety of disciplines are available to the designer. Their potential as tools for effective practice lie in the instructional designer's knowledge, creativity, intuition, and analytical skills. Applied to a design problem, the ID tools form layers that the instructional designer explores and adapts until, like pieces of a puzzle, they fall into place and form an innovative solution that meets target audience needs.

Instructional design is a young discipline commonly defined by its scholars as a systematic and reflective problem-solving process used to analyze instructional and informational needs, identify solutions, and design and develop support for learners of any age, in any environment. ID borrows from a broad array of theories, research, and experience-based models in the fields of engineering, education, psychology, cognitive science and business, among others.

> *An instructional designer is like an engineer. Both plan their work based upon principles that have been successful in the past... Both try to design solutions that are not only functional but also attractive or appealing to the end user. Both the engineer and the instructional designer have established problem-solving procedures they use to guide them in making decisions about their designs (Smith & Ragan, 1999, p.2)*

Instructional design literature often equates the birth of ID with the onset of World War II when educational psychologists and educational technologists joined forces to meet the training needs of the military (Richey, 1993; Saettler, 1990). ID practice has since evolved to address organizations' needs in environments that range from K-12 to higher education, government and military training, to a variety of corporate settings found in business and industry. Instructional designers in K-12 or higher education environments are often placed in positions as educational technologists with the responsibilities that range from curriculum development to incorporation of new teaching and learning pedagogues. Military-based instructional designers may need to develop training materials for classroom and field training but must function within a well-established hierarchy and policies that dictate performance objectives and goals. Finally, instructional designers in corporate environments may contend with novel situations that vary from project to project. In internal training departments, this often includes development of in-house training or information support materials. In the case of consulting companies, materials are designed and developed with or for external clients.

The models used to describe the ID process can be traced back to the early 1960s with the introduction of the first visual model, *Instructional Systems* in 1961 (Banathy, 1968). Using flow-charts and descriptive text, this model presented the stages of instruction systems design as analysis of a system, solutions for the system's problems, and subsequent development of a new system. The *Instructional Systems* model emphasized analysis as an iterative process rather than a "linear-causal orientation of classical scientific thinking" (Banathy in Gagne, 1985, p.87)

The iterative nature ID practice remained a guiding factor in the numerous instructional design models that were created following the publication of Banathy's *Instructional Systems* model (Gustafson, 1981; Hannafin, 1986; Reigeluth & Nelson, 1997; Richey, 1993; Rowland, 1993; Seels, 1989). Each model was an effort to reflect the evolution of the field and advances in learning theory, cognitive science, and system theory. Several adaptations were introduced to the ID process, including additions that helped streamline the process such as rapid prototyping and strategies such as performance support that helped create materials appropriate to today's work environments. Technologies available for learning materials changed rapidly as did the opportunities for mass distribution to learning audiences via computer technologies and the World Wide Web. In spite of these adaptations, the conceptual framework of instructional systems design models remained virtually unchanged since their development in the 1970s. They continued to emphasize the components that defined the ID process; analysis, design, development, and evaluation (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1988; Richey, 1986; Smith & Ragan, 1993).

Research in ID Preparation and Practice. During the years that followed the introduction of the first systems design models for instruction, higher education institutions began offering graduate programs in instructional technology and included instructional design as a part of their core curriculum. Many of these programs evolved from audio-visual or communications programs. The preparation of instructional designers was based on prescriptive theories that focus on what designers *should* do when designing instructional in actual practice. ID courses treated the ID process as a procedural, linear model used to solve design problems. This approach led the instructional designer through a process of solution identification, moving progressively from the problem towards the desired goal using a top down, procedural process (Ertmer & Cennamo, 1995).

As in any emergent profession, each environment of practice has helped shape and define ID practice and, ideally, each environment of practice should influence the professional preparation of its practitioners. This was the focal area of research into professional preparation in the 1980s and 1990s. We learned how expert instructional designers identify problems and interpret instructional needs (Rowland, 1991, 1992; Perez, 1995, Perez and Emery, 1995). We explored the dynamics of professional practice from designers who were from a variety of educational backgrounds (Pitlik, 1995; Atchison, 1996) and we learned about the diverse nature of ID practice (ASTD, 1983; IBSTPI, 1986, 2000; Atchison, 1996).

The competencies that were identified covered a full range of procedural, problem-solving, collaborative, management and technology skills and the dynamics of professional practice pointed to a need for increased focus on the transfer of theory into practice. Researchers recommended that graduate instructional technology (IT) programs provide learning experiences reflective of the complex environments found in actual professional ID practice (Quinn, 1995; Tripp, 1994). Their recommendations promoted such methods as real-world projects, case studies, and apprenticeship models (Rowland, 1992; Roland, Parra, Basnet, 1994; Perez, 1995; Quinn, 1994). ID instructors implementing these strategies began to explore coaching methods that would encourage their students to consider multiple perspectives and reflect on their design decisions (Tripp, 1991, 1994; Ertmer & Cennamo, 1995). Many of the strategies were adopted from other design fields, such as architecture and engineering, which had successfully implemented open-ended learning experiences that encouraged reflective practice. Their interest was to incorporate some of the skills that research into professional practice and cognitive learning theory uncovered such as collaboration, problem-solving, management, and effective, yet flexible implementation of the ID process (Rowland et al., 1994).

With instructional technology programs across the country exploring ways to adapt their core curriculum in this way, questions about the relationship between graduate IT programs and professional practice emerged. What aspects of the graduate IT education experience did instructional designers find effective in preparing them for professional practice? Were they able to transfer the core knowledge, strategies and methods they learned to actual practice? Or, did they struggle to draw connections between their graduate education and professional practice? The purpose of this paper is to present a comparative case study that explored the complex relationship between preparation and practice through an examination of instructional designers and their perceptions of academic preparation. Seven instructional designers in ID consulting firms provided insight into their academic and professional experiences and their recommendations for graduate IT programs. Through interviews, observations, and product reviews, this study attempted to examine:

- What instructional designers in this environment actually do,
- What parts of their academic training (content and methods) best prepared them for this, and
- What gaps existed in their professional preparation, as demonstrated by the knowledge and skills they had to develop in actual practice.

Method

The exploratory nature of an inquiry into characteristics of instructional design practice and academic preparation, suggested an interpretive case study approach using naturalistic, qualitative methods. An interpretive case study employs naturalistic inquiry to inductively understand participants' experiences in the environments in which they practice. Thick, rich descriptions illustrate complexities and enable an in-depth exploration of phenomena (Lincoln and Guba, 1985; Patton, 1990). Broad topics initiated the inquiry, which were later refined to themes and explicit questions that led to a tentative hypothesis and eventual conclusion (Marshall & Rossman, 1989).

The diversity of practice environments presents a continuing need to interpret what designers do in various domains so that we may effectively prepare novice instructional designers for successful practice. In this study, I focused on one specific domain of practice, companies that produce ID products for external clients. This enabled me to gain an in-depth understanding of the effectiveness of academic preparation and the dynamics of professional practice in this particular setting. Purposive sampling identified the seven academically trained instructional designers from four Instructional Technology graduate programs. The participants had been working in this capacity for no less than three and no more than five years. This time span ensured that the designers had sufficient professional experience to reflect on actual practice, yet could still recall the details of their academic preparation.

In naturalistic inquiry, the design of the study is emergent. Data collection and analysis were conducted simultaneously. In-depth interviews followed a semi-structured format in the natural work setting of the instructional designers. Questions emerged to elicit the designers' approach to ID practice. The participants were encouraged to speak freely about any topic related to academic preparation and ID practice. They described adaptations they had made to the methods and strategies they learned in graduate school and what they felt best prepared them for actual practice. A tour of each participant's work environment, a review of recently completed projects, and company literature ensured a holistic understanding of the phenomenon under study. The participants received a copy of their interview transcripts and participated in a follow-up telephone interview that confirmed the accuracy of the transcripts and my interpretations of their experiences. The telephone interview also took the form of a semi-structured format, focusing on questions that emerged from a preliminary analysis of the initial interview responses.

All interviews and supporting materials were coded based on the Miles and Huberman procedure, beginning with an initial coding scheme that was subsequently developed for each participant after the first interview. The constant comparative method of Glaser and Strauss (1967) as interpreted for naturalistic inquiry by Lincoln and Guba (1985) guided analysis of the data; social phenomena were compared across categories as they were recorded and classified. This description, interpretive commentary and direct quotes from the interviews conveyed the meaning of everyday life at the site and ground the categories with full descriptions of the natural sequence of events prior to and during actual practice.

Results and Discussion

A cross-case analysis is presented according to the emergence of themes within three major categories, strength of academic preparation, professional practice, and skills learned on the job, and the participants' response to the final question, "What recommendations do you have for graduate IT programs?

Strength of Academic Preparation. Academic programs that prepare instructional designers are most likely to be in a School of Education (Heinich, 1995). Of the four instructional technology graduate programs represented in this study, one constituted a separate college and three were programs housed within schools of education. One might therefore assume that the majority of students entering these programs would come from K-12 education backgrounds. However, students enrolling in IT graduate programs come from a variety of disciplines, and many enter graduate school soon after they complete their undergraduate degrees. This was the case for the five of the seven participants in this study who had earned degrees in English, environmental science, and communications. The four participants who spoke about their decision to attend graduate school soon after earning their bachelor's degrees felt that there were limited employment opportunities for their major. As Casey explained, "Being an English major and all, I don't think that left me a lot of (career) options," and she didn't feel ready to enter the workforce; "I wasn't sure what I wanted to do with my life so I went to graduate school."

Instructional design is an emergent profession whose members continue to define its practice according to the type of environment and the perceptions of those who have a stake in the instructional outcome (Ritchie, 1999). As a result, students entering graduate IT programs often are unable to specify precisely what job they will hold when they graduate. All of the participants knew that they would be integrating technology with instruction in their work, but thought that their primary responsibility would be the development of instructional multimedia products. As Anne noted, "My expectation was that it was going to be more technical than it was. I thought I would be more of a developer." Instead, these individuals found that their work focused more directly on the design of instruction. Additionally, all but one participant thought they would be designing and developing educational software applications for children. The exception, Anne, chose her graduate program because of her experience working for a distance education program in a university medical school.

Foundations in Specialized Knowledge. A professional education begins with an introduction to the profession's "specialized body of knowledge," those explanatory and applied theories and doctrines "that must inform and guide and provide a repertoire for reflection" (p. 34, Harris, 1993) in practice. Although Schon (1983) argued that professional expertise results from practical knowledge, the development of the tacit, higher level problem solving skills used in actual practice, he recognized that this specialized knowledge within each profession has its place. This "technical knowledge," serves as the framework upon which professionals begin to build the knowledge base that guides the experiences leading to professional expertise. In the field of instructional technology, this foundation for professional practice commonly falls into three categories: instructional design, learning theory, and technology. These are the predominant topics described by the participants in this study as forming the foundation for their professional practice:

> Grasping at the fundamentals... I think that's basic. Just like it is for the architect who needs basic math, you have to know that to go to the higher levels. They are key foundational pieces for my practice and, depending on how the design builds on that is whether or not the instruction is effective. (Laura)

Several participants also considered research methods a part of their foundation because it enabled them to understand the research literature and theoretical underpinnings of the concepts they explored in their other classes. For some, the research methods course also enabled them with skills to interpret research on current trends and topics relevant to products they designed.

The participants also noted two areas that project management and human relations should be included in the foundations courses for ID practice. They recognized that these skills develop in actual practice, but felt strongly that an exposure to the management, communication and interpersonal skills that they use on a daily basis would give instructional designers a foundation that they could build upon. Laura was the only participant who attended a project management or human relations course; she found that the case scenarios her instructors used provided her with a springboard for identifying solutions to similar challenges. She did not begin to comprehend the complexity of management and conflict resolution until she applied these skills in actual situations.

Transitions to practice. Some participants found that traditional classroom activities such as presentations, guided discussions, and reaction or research papers were appropriate for their explorations of the history of the field or the learning theories that form the foundation of design. Three of the participants, for instance, expressed an appreciation toward their instructor's dynamic lectures and the breadth of materials they explored in their learning theory courses. Although they continue to study and review learning theories as the need arises, this foundation enabled them to help the client understand and determine "the pedagogical approach" that is most appropriate for the target audience. Other participants did not invest in these courses because they could not see the relevance of the topics they were studying to what they envisioned as professional practice at the time.

The same participants who appreciated the traditional classroom environment for their exploration of theories agreed with their counterparts, however, that applied skills and knowledge should directly reflect actual practice. "*The real-world projects and the combination of ID with technology were the real strength of our program* (Sharon). The participants identified four instructional methods that they considered appropriate for developing their skills and knowledge for professional practice: discussions with expert instructional designers and business owners, explorations of real-world examples, real-world projects, and case-studies.

Those who had the opportunity to participate in real-world activities expressed an appreciation towards their instructors for coaching them throughout their projects and helping them reflect on their options and evaluate their decisions. The instructor-coaches guided the learners in a review and reflection on their decisions and the resulting outcomes. In doing so, learners internalize the design process, which leads to a holistic awareness of the interdependence between its component parts (Schon, 1987). If an instructional designer understands the purpose and interrelationship of the component parts of the ID process, he or she understands how to adapt its component parts as needed to obtain acceptable results. This leads to effective design and development in almost any situation (Jonassen, 1994).

One of the participants, Casey, for instance, described her "real-world" ID experience in an elective ID class facilitated by an instructor who coached the students through each stage of the Dick & Carey model as they created instructional products. Coupled with the instructor's guided discussions, her review of papers they submitted on related topics, and her one-on-one feedback, Casey began to grasp the purpose of the stages of the ID model and recognized the value of the ID process. "If you look at (the ID process) in pieces, each of the pieces is adapted in some way."

From Preparation to Practice. An analysis of the individual differences and specific issues connecting perceptions of academic preparation to professional practice emerged as three profiles of ID practice: Innovator, Traditionalist, and Practitioner. Within each of the three categories, the participants reflected similar types of expertise. The Innovators reflect the skills and characteristics used to describe the successful ID professional. They are "Innovators" because they exhibited a common characteristic; an inner confidence that enables them to think "outside-the box" and motivates them take the creative risks that lead to innovative solutions. The single "Traditionalist" follows a unique path towards expertise, a traditional model of apprenticeship. The "Practitioners" exhibit some of the skills exhibited by the Innovator to a lesser degree, but tend to accept instructional problems from clients and their requested solutions at face value.

Many of the different characteristics that describe the expert to novice continuum are reminiscent of the characteristics proposed for Innovator, Traditionalist, and Practitioner. Towards one end of the continuum, the Innovator exhibited characteristics of the expert, who is able to solve problems in new situations by mentally organizing previously acquired knowledge and applying it in a meaningful way (Gage & Berliner, 1984). According to the Dreyfus model of skill acquisition, the Innovator is similar to the fifth and final level on the continuum between novice and expert, appearing flexible and easily adapting to the demands of new situations (Dreyfus & Dreyfus, 1986). The Traditionalist, Jenny, was unique. Although she considered herself a novice and was cautious about making decisions without the guidance of her mentors, she drew from her ID experiences to consider multiple influences when approaching problems and alternative solutions. The Traditionalist had begun to internalize the rules and procedures she followed and thus, as the proficient performer (level four) in the Dreyfus model, she was beginning to use her previous experiences to make intuitive decisions (Dreyfus & Dreyfus, 1986). The Practitioner exhibited some characteristics of the novice designer, who bases his or her judgments on surface issues that are immediately apparent (Chi, Glaser & Far, 1988). The Practitioner is similar to the advanced beginner (level two) in the Dreyfus model, drawing from previous experience, but requiring guidelines to perform at an acceptable level (Dreyfus & Dreyfus, 1986).

Innovators. The Innovators considered themselves lifelong learners and viewed their graduate experience as a foundation for practice and continuing their education. Their most noteworthy characteristic was their pride in their profession and the products they created. As did the experts in the expert-novice problem-solving research conducted in the early 1990s, the Innovators were not afraid of ambiguity; they approached each new challenge anticipating that there were multiple influences and solutions to any situation.

Whether the project called for new, original materials, supplemental activities for existing content, or repurposed coursework, the Innovators extracted as much information as they could about the target audience and their learning or work environments. Expert instructional designers often spend more time than novices on the needs assessment because they interpret problems as ill-defined and consider multiple factors that might influence the situation. They also spent more time on the front-end analysis of the tasks that the learners need to perform (Rowland, 1992; Tripp, 1991, 1994; Perez, 1995; Perez & Emery, 1995; Quinn, 1995).

Experts guide practice by creating mental prototypes that integrated prior experiences with their technical and practical knowledge (Boreham, 1987). This process requires both intuitive and analytical skills to analyze the complex situations that exist in actual practice and identify novel solutions (Hammond, 1980; Dreyfus & Dreyfus, 1986). Laura attributed her ability to push the envelope to her experience as an improvisation comedienne and Josh found creative ways to adapt experiences and knowledge from other disciplines to identify needs and create new solutions for his clients. Casey accomplished this by surrounding herself with experts (she saw all of her colleagues as potential teachers), encouraging collaboration among her team members, and guiding them through the ID process. Likewise, all of the Innovators helped their colleagues see "outside-the-box" by taking risks and guiding them in creative explorations of the design process. Since the Innovators were confident in their expertise, the expertise of others did not intimidate them and they welcomed collaborators' contributions to the creative process. This aspect of expert practice has not yet been explored in the research into expert-novice development.

Practical knowledge is an intuitive artistry involving the interpretation of theories and methods within the expert practitioner's domain of practice and adapting them to meet unique specific needs (Brumbaugh & Lawrence, 1963). The Innovators were similar to Pitlik's (1995) "Adapters" in that they had confidence in the ID process, "it can be effective in almost any situation" (Josh), which they see as utilitarian rather than prescriptive. They did not allow an ID model to dictate how they practiced design, rather they adapted what they learned from the model to interact with a situation and their colleagues. The "Innovator" differed from the "Adapter," however, by adapting ID methods and strategies *within* each stage of the ID process rather than adapting to the process by foregoing critical stages of the model such as front-end analysis. "If you look at it in pieces, each of the pieces is adapted in some way" (Casey).

Shifts in the way organizations function in society, such as the technology and communications explosion, a global economy and shifting employee roles, continue to influence the evolution of the instructional design profession (ASTD, 1993). The concept of change in organizations is a constant, and organizations' members must have the skills necessary to increase efficiency and productivity while identifying innovative solutions that will give them the competitive edge in their market (Davies, 1997). Instructional designers must meet similar demands, but they also need to function as change agents who can guide employees in the development of their problem-solving skills, their ability to meet new challenges and the development of their lifelong learning skills. The Innovators in this study seemed best equipped to meet this demand because they exhibited the ability to lead their colleagues in the process of identifying needs and designing effective solutions. The Innovators founds ways to create efficient and timely instructional solutions by adapting to the ID process, yet they tried to do so without sacrificing the integrity of the instructional materials they created.

Traditionalist. Like the Innovators, Jenny fully embraced the ID process as a collection of methods and strategies for defining problems and identifying solutions. She considered herself a novice designer, however, and was cautious about moving forward on her own. In the areas in which she felt competent, whether note-taking during needs assessments, conducting preliminary task analyses, or designing instructional strategies, Jenny paid careful attention to detail and sought to emulate the expert designers who guided her projects.

Jenny felt her graduate experience might have been more transferable to professional practice had she been cognizant of her professional needs rather than limiting her focus to her current interests at the time. Despite the limitations Jenny set upon her own graduate experience, she still felt the foundation she gained in ID enabled her to enter the field. Osman and Hannafin (1992) explained that expertise develops over time as the novice works through problems that progressively increase in difficulty. Under the guidance of experts, the skills are internalized with each new experience. This foundation prepared Jenny for a life of learning through continuing education and, more importantly, experience working as an apprentice to expert practitioners.

Practitioners. The Practitioners viewed their graduate experience as a foundation for practice, yet they felt that the study of instructional design was more of a means to an end, their degree, rather than a part of their lifelong learning experience. Instructional design, they felt, enabled the Practitioners to enter the field. It also "provided a framework for the process" (Anne, Chris) and "without this background knowledge, you run the risk of designing something that is not instructionally sound" (Sharon).

The Practitioners' focused their continuing education on remaining current with the latest technologies and learning theories related to their definition of ID practice in the "real world:" instructional strategies, interaction and interface design. They agreed that ID, "in theory," influenced their decision-making, but felt that the systematic ID process they learned in school had limited application in a client-based, corporate environment. The Practitioners attributed this to the expectations of the clients who usually "internally identified the need and solution" because "they know exactly what they want presented and they have the content for us to create interactions (Sharon)."

Novices characteristically interpret problems at face value and consider few influencing factors, one at a time. They tend to move immediately to the generation of solutions and attempt to apply them (Berliner, 1986, 1991; Chi, Feltovich, and Glaser, 1981; Schon, 1983, 1987; Chi et al., 1988; Eraut, 1994). Likewise, the Practitioners took design problems at face value and did not question the client's instructional objectives or proposed solutions. They firmly believed that "the client drives so much of everything (Chris)" and "actually having real clients makes it less likely that the instructional design process is going to be followed (Sharon)."

This was the most noteworthy characteristic of the Practitioners, yet it is the most difficult to understand. Although they had similar graduate experiences to the innovators, (Chris and Sharon [Practitioners], and Josh and Casey [Innovators] attended the same graduate program) the Practitioners' description of their approach to the ID process was reflective of novice problem-solving characteristics. They described their process in concrete terms and tended to see single factors influencing situations and driving instructional solutions (Berliner, 1986, 1991; Chi, Feltovich, and Glaser, 1981; Schon, 1983, 1987; Chi et al., 1988; Eraut, 1994). This difference suggests that the Practitioners develop expertise at a different rate than their counterparts, the Innovators. Factors affecting this discrepancy may include the climate of the instructional designer's work environment, projects or individual personality traits. Chris and Sharon, for instance, entered a work environment that focused on projects that supplemented existing content. Coupled with their perception that instructional design in actual practice begins with instructional strategies, they did not consider alternative needs or solutions to the learning needs they were addressing. Anne was a Practitioner who felt that she was a novice instructional designer looking to her graduate experience to guide her actions in her new job. Her previous job did not require her to employ the entire ID process and she believed she developed habits that compromised the quality of ID, such as moving directly to the design and development of instructional solutions. Innovators Josh and Casey, on the other hand, found opportunity to adapt each stage of the ID process to extract the information they needed. Josh demonstrated his skills to potential employers and they hired him as both instructional designer and content expert. As a result of his dual role, he found that he had considerable influence on client decisions about the ID process and their selection of alternative solutions. Casey responded to the environment where she worked, by leading experts from a diverse range of disciplines through the ID process.

Like the advanced beginners described in the Dreyfus Model of Skill Acquisition (Dreyfus & Dreyfus, 1986), the Practitioners followed the rules they understood. They practiced their craft by organizing content and designing the "presentation" and "interactivity" based on the clients' guidelines. They did not see the ID process as a way of exploring a situation in multiple ways. They valued its structure, yet considered it an ideal, a "theory," that could not exist in a world where the primary source for the need and identification of the solution was the client and/or subject matter expert. For Anne, this discrepancy between academic preparation and practice diminished her sense of accomplishment because it made her "feel guilty about the product that you produce in the commercial world."

Skills learned on the job. The most common skills the participants learned on-the-job were the collaborative, management and interpersonal skills. The participants also noted that several of the skills they learned on-the-job expanded upon the foundations they formed in graduate school. This included technology as well as ID related skills such as learning theory, research and evaluation. (It is important to note here that some gaps in this analysis may exist because a respondent did not comment on it rather than indicating that this skill was not learned on the job.) Laura expressed this sentiment about her technology skills, "I think there is definitely a technology learning curve that never stops," and most of the participants anticipate that this knowledge base will continue to grow throughout their careers.

Participant Recommendations. Most of the participants pointed to a need for courses that address the dynamics of professional practice and prepare them for the challenge to continue developing these skills on-the-job. Several of the participants, for instance, noted a discrepancy between their academic focus on K-12 applications of instructional design, and their application of adult learning theory and in actual practice. All but one participant thought they would be working exclusively with K-12 learners in professional practice and, consequently, none of the participants sought additional coursework in adult learning while they were enrolled in graduate school. And, as one participant noted, employers often assume that graduates of instructional design programs have a background in adult learning theory and exposure to methods that can meet the needs of the diverse target audiences they encounter in actual practice.

Organizations today are focusing on their future by creating work environments that encourage collaboration, teamwork, and shared knowledge. Skills in the areas of human relations, social intelligence, are critical to successful professional practice. With the exception of Jenny, all of the participants found that team building and collaboration were significant components of their professional practice. (Jenny anticipated that she too would need these skills as she moved into a project management role in the future). Consequently, they felt they were continually challenged to improve their professional interpersonal skills. Laura was the only participant, however, to attend a course in human relations; her college included this course as a part of the core curriculum. She noted that, although these skills had not fully developed when she began to practice instructional design professionally, the course laid a foundation for her interpersonal skills development. She was able to recall issues covered in class activities and apply these problem-solving skills to similar situations.

The participants noted several areas of project management that they developed on-the-job including client negotiations, delegation, scheduling, budgeting, and project projection, among others. Most of the participants recognized that project management skills are applied in complex multidimensional situations and, therefore, must develop in professional practice. They emphasized, however, that project management experiences in graduate school might provide them with the tools and methods that would ease their ease their transition to professional practice.

Recommendations: instructional methods for academic programs. The instructional designers in this study entered their graduate programs without an understanding of instructional design as a method or a profession. The vision of professional practice they held often influenced their perceptions of what coursework was relevant and guided their focus throughout their graduate programs. Consequently, they felt they were inadequately prepared in these areas of professional practice. Exposure to ID professionals when students enter their graduate programs could help novice designers build an accurate perception of professional practice early in their academic experience. Subsequent visits can focus on a variety of issues or environments of practice; as the students' conceptual and applied understanding of the ID process and related disciplines increase, so will their depth of inquiry about professional practice.

Most of the participants in this study assumed that, as an instructional designer on production teams, they would play a significant role developing components for products. A panel discussion with a production team, including designers, project managers, and developers could help students understand the interrelationship between designers and developers in actual practice and the skills an instructional designer applies to this stage of the design process.

The results of this study suggest that multiple factors, including learning readiness, prior experience and learning styles, can affect the novice designer's reception and cognition of these disciplines as foundations for professional practice. While some participants were able to draw connections between the core topics they covered in their graduate studies and ID practice, some interpretations misled them. For instance, the perception that the ID process is separate from the design and development of technology-based instruction or the conception that constructivist learning environments require opposing design methodologies to the ID process. Most of the participants did not draw critical connections until they began professional practice. Some participants never drew these connections. This suggests that novice instructional designers would benefit from an increased focus on the relationship between the concepts and skills they are learning and actual practice.

Connections between specific content areas need to reflect how each area influences actual practice. Professional instructional designers do no apply their ID, learning theory, technology, or project management skills in isolation; these skills and knowledge are interdependent and interrelated. IT programs and instructors can help the beginning designer understand this interrelationship by modeling application of the various disciplines in each of the core IT classes. This strategy should begin when students enter their graduate program. A survey course on the history of the field, such as the course Josh described for instance, can provide a global understanding of the role each foundation holds in professional practice. The interrelationship between the theoretical and practical knowledge of the field can then increase in complexity as the students move into advanced courses, and from exploration towards actual application of these skills in the design and development of instructional materials.

The adoption of such an integration strategy might, in many IT programs, place a significant demand on IT instructors by necessitating increased collaboration in the design and implementation of the program area courses. One possible alternative is a method that I explored in the University of Virginia ID course that I have co-facilitated; we added a lab to the core ID classes and used this time to facilitate student explorations of the practical relationship between their ID and the other disciplines. Again, student response to this opportunity was enthusiastic, although it required considerable guidance to keep the students on track and engaged in each others' explorations. This method could be applied to all of the core IT classes and, although there were be overlap in some instances, the students would begin to understand how these concepts apply to professional practice.

Several of the participants in this study also indicated that the skills and knowledge they developed in graduate school were only the building block for a foundation that they expect to continue expanding throughout their career. Student resource portfolios, another method that we applied in the University of Virginia ID courses, can help novice instructional designers organize their academic course materials so they can serve as reference materials for this ongoing exploration. In addition to their use as a resource for professional practice, the process of creating the portfolio requires the novice designer to analyze the materials and consider how they might apply to actual practice. This can increase the relevance these topics hold for the novice instructional designer. It can also serve to demonstrate that the foundation acquired in graduate school provides a framework for lifelong learning.

Prior research into the development of practical knowledge and professional and ID skill development suggest that experiences reflecting actual practice are critical the development of a professional designer. Likewise, all of the participants recommended experiences reflective of professional practice and most of them recommended real-world ID projects with actual clients. The participants who had this opportunity emphasized their appreciation for their instructor-coaches who led them from simple to complex applications of the ID process and provided guidance and feedback that encouraged them to consider multiple perspectives and potential solutions.

In addition to the real-world projects, many of the participants' programs offered credit for internships in work environments thought to reflect the type of work environment the student planned to enter in professional practice. Internships can provide novice instructional designers with experience applying the technical and practical knowledge expected of professional instructional designers. On the other hand (and as evidenced by one of the participants in this study), internships may not always provide the student with an experience reflective of professional practice in instructional design. This investigator contends that the instructor should ensure the student is placed in the appropriate work environment. Under the guidance of a university professor who can encourage reflection on practice and analysis of the experience, the intern can successfully explore the dynamics of professional practice.

The participants in this study also described their struggles with a variety of challenges including project management, client negotiations, team dynamics, and ID projects in environments that were foreign to them. Other fields such as business, law, and medicine and, more recently, the field of instructional design, have demonstrated the effectiveness of case-based learning. Case studies present realistic narratives of real world situations and problems. Case study analyses facilitated by instructor-coaches can expose teams of novice instructional designers to multiple environments. Teams can explore messy situations in a safe environment and gain experience solving the types of problems they may encounter in actual practice.

As the participant, "Laura," explained, she drew from case study experiences that addressed issues similar to the challenges she faced in actual practice.

Future Research

This study of instructional designers' perceptions of academic preparation and practice has been reported with an emphasis on the transfer of skills and knowledge developed in graduate school to actual practice and those skills practitioners developed on-the-job. It was found that ID professionals, who are assured of confidentiality, might be open, honest and willing to reflect on their successes and failures as instructional designers. Despite significant differences between each participant's experiences, several common themes emerged suggesting that IT programs are addressing many of the skills that novice instructional designers employ in professional practice. This is in line with prior research into the competencies of professional instructional designers (ASTD, 1983; IBSTPI, 1986; Atchison, 1996).

This study provided a glimpse into the professional lives and academic preparation of instructional designers who develop instructional materials for external clients including products for educational publishers, government and related industries, and entertainment clients, among others. The dynamics of ID practice vary significantly across practice environments and each situation presents unique demands for the ID practitioner. Further qualitative studies addressing a variety of practice environments will provide data on the relationship between academic preparation and these specific work environments. The investigation of additional ID work environments can help to identify the variations in professional ID practice. Subsequent comparisons across practice environments will enable us to increase the generalization of our findings to multiple environments in the field. It would also be interesting to develop detailed case studies about the production and development of an entire project in each of these environments.

This study presented a variety of academic environments and stressed the need to establish the relevance of the theories, concepts, and procedures explored in graduate IT programs by demonstrating their interrelationship and interdependence in ID practice. Further studies into the structure of academic programs and the interrelationship of the curricula is warranted. This study identified some of the teaching methods that are perceived to be effective in learning ID and pointed to some teaching methods that are thought to be ineffective by some designers. The result of this study also suggests further research in this area. A profile of the professional instructional designer is ripe for investigation. An exploration in the relationship between ID students and the three profiles, Innovator, Traditionalist, and Practitioner can help provide insight into the characteristic of successful transfer from preparation to practice.

This study paralleled prior research that identified proficient designers as flexible and adaptable, able to solve complex ID problems in a diverse range of environments, and create innovative solutions. It was found that instructional designers may begin to develop these skills through instructor coaching, guided reflection, and experiences that emulate actual practice such as real-world projects and case studies. For some instructional designers, these methods, along with the foundations, skills and knowledge that novice designers develop in graduate school and in their early years of practice, enable them to apply what they learn to professional practice and lifelong learning.

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TEACHING, LEARNING, AND COMMUNICATING IN THE DIGITAL AGE

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Abstract

Younger students live in a media-centric world. Researchers have shown that youth today spend more time watching television and movies than most any other leisure-time activity (Pearl, 1982). In addition, the presentation speed of passages on commercial television has increased significantly in the past fifty years (Stephens, 1996). Researchers have shown that viewers automatically learn to cope with symbolic presentation methods through repeated exposure to television and visual patterns (Abelman, 1995; Bargh, 1988; Carr, 1982). Because of their increased exposure to rapid sequence and presentation speed brought on by fast-cuts/montage found in television programs aimed at youth, it may also be assumed that these individuals can comprehend these messages on a much wider scale than can their adult counterparts. One cannot assume that exposure to rapid presentation speed is simply a passive viewing activity. Further, not only are these advancements in media technology changing the way viewers look at and interpret video media, but most importantly, the widespread availability of production techniques provide easy access to capabilities that allow people to use video media to easily create their own content. It has been widely shown fashion (Tyner, 1998) that these acquisition/production opportunities also increase exponentially one's ability to comprehend content delivered in like.

Media educators and theorists for years have been analyzing Marshall McLuhan's famous quip, the medium is the message. In some regard, McLuhan's statement may be a retort to later critics of educational media like Richard Clark (1983) who claimed that media are "mere vehicles that deliver instruction but do not influence achievement any more that the truck that delivers groceries causes changes in nutrition" (p.445). Further, communications theorists like Walter Ong (1982) not only agreed with McLuhan, but extended the meaning of McLuhan's message to also imply that the types of media people use define the way they think. Ong's notions bring to mind possible questions as to whether today's mediacentric youth perhaps think differently than previous generations, with implications as to the kinds of instructional strategies that will be successful in motivating them to learn and providing perceptual stimuli for recognition and recall.

Background

Media educators and theorists for years have been analyzing Marshall McLuhan's famous quip, *the medium is the message* (Meyrowitz, 1985). In some regard, McLuhan's statement may be a retort to later critics of educational media like Richard Clark (1983) who claimed that media are "mere vehicles that deliver instruction but do not influence achievement any more that the truck that delivers groceries causes changes in nutrition" (p.445). Further, communications theorists like Walter Ong (1982) not only agreed with McLuhan, but extended the meaning of his message to also imply that the types of media people use define the way they think. Ong's notions bring to mind possible questions as to whether today's mediacentric youth perhaps think and cognitively perceive differently than previous generations, with implications as to the kinds of instructional strategies that will be successful in motivating them to learn and providing perceptual stimuli for recognition and recall.

The increased predominance of digital technology in our daily lives is no accident. In 1996, the Federal Government mandated, through the Telecommunications Act of 1996, major changes in the way television signals are to be transmitted. Digital and high definition (HDTV) television would become the standard by 2006. In exchange for the broadcast industry having to absorb the multi-millions of dollars in cost for this conversion, the FCC also made significant favorable changes in limits on cross-ownership, which have encouraged an overall industry-wide consolidation. The end result has been a phenomenon called *digital convergence:* the combining of the telephone, the computer, and television into one technological *box*. Alan November (1998) re-labeled this new technological machinery, calling it a "Digital Combine", in obvious reference to the agricultural combine that was invented during the 1930s. Traditional farmers who worked the land by hand fought this advancing technology as depicted so well in the movie The Grapes of Wrath. In a famous scene the character, played by Henry Fonda, was complaining to the other squatters that these new Cats were pushing them off their land. November's analogy is clear. Educators who cling to (i.e. squat on) their old ways will suffer a similar fate and will be pushed off their turf if they do not learn how to co-exist with the latest technological *cat* - new media technologies that are so prevalently being used and mastered by today's youth. A change in educational techniques is inevitable. What must be done is to figure out how and when, not if, this new *combine* will be incorporated into instructional designers' thinking about the current batch of students, who are steeped in exposure to new media.

As a result of digital convergence and other new ideas, the predominant types of production techniques in use today in electronic media are changing. Encouraged by the successes of early pioneers of rapidly paced music video montages on networks like MTV, VH1, and Nickelodeon, and helped by rapid advances in technology, today's television producers regularly communicate fairly complex messages using fast-cuts and video montage (Stephens, 1996). Significant increases in viewership of these types of programs appear to be providing fertile opportunities for today's youth to practice their ability to receive and understand this fast-paced message delivery. According to Seward-Barry (1997), sleeping has become the only activity that occupies children's time more than watching television (or, more recently, playing video games). For these reasons, a change in the way in which educators look at learning from electronic media may be warranted. This thinking appears to be incompatible with earlier communications theorists like Edgar Dale (1969), who felt that television finished somewhere in the middle of a twelve-point influence scale in its ability to convey contextual ideas. Moreover, using television in education appears to be anathema to recent spokesmen like Neil Postman (1986), who feel that it adds nothing positive to the mix and may even be detrimental to learning and cognition. However, new media that employs visual imagery supplemented by motion, sound, and computer editing is perhaps finally positioned to evolve into a similar definitional prominence to the peop le who use them, just as print media had done for the past five hundred years since Guttenberg (Stephens, 1996, p. 69). Corcoran (1981) suggested that intelligence is a skill in a particular medium and that symbolic codes used in that medium that serves communication purposes and are internalized by a receiver also serves as a authentic tool of thought. This new way of thinking may be at the root of generational differences in communication techniques and over-dependence on the right brain for thinking in today's youth. It has also brought to mind a revelation on the part of this author. Just because a student does not know the words to communicate his or her thoughts does not necessarily mean that he or she is not having any intelligent thoughts. Perhaps, the ideas are coming to these individuals in different ways. Investigation and follow-up has made some things much more clear. Educators need to look differently on communicating and educating today's mediacentric youth.

The Medium is the Message Re-visited

The idea that the learning process might be changing as the result of the types of predominant media being used is appears to be backed up by several research studies by Jonassen (1996) and others in which technology/media has been successfully evaluated as type of cognitive *mind tool*. In other words, by merging many formerly distinct knowledge situations, new media appear to be "breaking down the boundaries among various disciplines, opening new di alogues, and fostering the development of cross-disciplinary areas of study" (Meyrowitz, 1985, p. 327). These new kinds of electronic media, Meyrowitz (1985) speculated, may be "introducing our children to a different way of thinking that involves the integration of multiple variables and overlapping lines of simultaneous actions" (p. 326). This assertion proposes, among other things, that electronic media in general (and television in particular) may have already greatly reduced the influence that time and location used to have on what people know. It is, therefore, not unreasonable to propose that a transition may be in process in which the youth of today think about things, all of which appears to be at odds with the linear thinking processes associated with print media (Stephens, 1996). Further, it is also possible that today's youth may be moving away from a "one-thing-at-a-time, one-thing-after-another, and take-time-to-think world of reading" (Meyrowitz, 1985, p. 326) towards McLuhan's world of "interconnected layers of information" in which "a continual superimposition of complex contextual matrices, all arrive (sic) into the brain at an electric speed" (McLuhan, 1964, p. 91).

The Medium is the Message, Part 1

Perhaps the best way to analyze the impact of new media on teacher youth in the digital age is to re-look at McLuhan's *medium is the message* ideas with a view to some modern interpretations. One interpretation of the medium is the message concept involves how we should evaluate the innate goodness or badness of the media we use. In general, this assessment can be interpreted in four ways. Technology (As an aside, the terms technology and media/new media should be inter-changeable here) needs to be assessed in the following ways:

- What, if anything, new does it bring to the table (i.e. what good is it doing for the culture who is using it?)
- What does its introduction into a culture make obsolete?
- What, if anything, does it bring back that might have been obsoleted by a previous new technology?
- What happens when people using this new technology over-depend on it?

In most general terms, this interpretation of the usefulness of technology has very specific implications for educators who are looking into teaching and communicating with today's media-centric youth. First, new media provide complete interactivity at a very small price. Without having to leave their classrooms, students can interactively explore cloud formations that occur during major hurricanes, compare bone structures between humans and apes, look at generational genetic similarities, and explore the human body in very dramatic form. Streaming video and the Internet are helping to redefine the distribution of educational materials. For example, the National Library of Medicine at the University of Maryland has put online the Visible Human Project, in which students can view an actual human's anatomy from the top of his head all the way throughout to his feet, using cat scan technology that has been exported to a Quick Time Video. These virtual field trips are becoming increasingly prevalent and commonplace on the Internet. Second, new media technologies (the Internet, in particular) appear to empower and encourage students to communicate using the media. Producers of new media are offered broad new opportunities to immediately practice their skills through ready-made distribution channels for a new population of motion picture and video practitioners. Marc Davis from the MIT Media Labs likened his phenomenon to that of younger musicians practicing in their garage. "In the spirit of garage bands, the Internet and new video technologies provide ready-made distribution channel for a new pop ulation of motion picture (and video (sic)) producers, as practitioners of garage cinema" (Davis, 1996). A more famous example was the way that the Blair Witch project got off the ground, using the Internet first as a means to introduce and market the product prior to its general release in major movie houses across the country. Several Internet sites like Always I.com are popping up that encourage amateur producers to post their work. No longer do today's youth have to wait to grow up and move to Hollywood in order to get their works published. These new opportunities are encouraging youth all over the country to create and communicate using media technologies. Classroom teachers need to tap into these opportunities and role models to make connections with their students, who are already spending considerable amounts of their leisure time in these activities.

If one follows John Keller's ARCS motivational model (Keller, 1983), it shouldn't be too hard to see how relevance and success with new media may be translated into making successful connections with today's mediacentric youth. A word of caution - new media cannot be looked at without also keeping in mind the fourth law of media evaluation mentioned previously. Over-depending on new technologies does have its downside. New media tends to affect right-brain development, whereas text-based cognition is left-brain. An over-dependence on one side or the other is not fully developing one's potential and can leave a child ill equipped to fully function in the world. As Robert Doman, Jr. (1984) very often preached, one should teach to one's strengths and remediate any weaknesses, and not the other way around. A failure to do this is doing our youth a disservice.

Teach to the Strengths, Remediate the Weaknesses

The obvious point here is that educators should teach to a student's strengths (i.e. right-brain development) I order to remediate their possible weaknesses (i.e. text-based or left-brain cognition). Use visual skills to get at textual. Using media as a cognitive development tool has incurred significant success in several literacy projects recently. These projects utilized students' fascination with the technology of television and video production as a hook to encourage them to develop their non-verbal (i.e. oral and visual) story-telling skills that eventually translated into their acquiring increased text-based communication abilities. These students haven't needed too much prompting to want to write about their own personal visual experiences and/or story lines. Marco Torres' work with inner-city youth in east Los Angeles, as well other similar projects in San Antonio, Texas, and in Ohio have been very successful in bringing otherwise lost children back into educational the fold so-to-speak. By first teaching students how to communicate non-verbally and then having them utilize their own projects to develop their verbal communication skills has paid big dividends.

Remediating weaknesses and learning disabilities appears to be another way that new media has helped shape personality and development. For example, researchers have found that video games can interact with subjects to positively influence cognition. Physicians and researchers at the Medical Center at the University of Eastern Virginia have been able to attain significant results in treating ADHD students with a non-invasive, non-medical treatment using video games to increase attention spans and to increase cognitive activity. Subjects are hooked up to bio-feedback apparatus that monitors attention while they play popular video games. As subjects' attentions drift, the feedback mechanism makes the joystick attached to the game more difficult to operate. The subjects are prompted to again attend to what they are doing. They are incented to stay on task because of a built-in desire to play the game. Positive long-term effects appear to warrant the use of this program to cause subjects to change their cognitive behavior (i.e. attending to a task) relative to capabilities and habits prior to entering the program. Most can be taken off therapeutic medications in the process.

Research appears to back up these projects. While some have deprecated the over-use of media (Dale, 1969; Neuman, 1976; Postman, 1986)), others (Gropper, 1966; Nugent, 1982; Paivio, 1986) have found that the use of video media can actually increase one's retention for stories presented via the combination of visual and auditory information that those presented through only a single source. It is, perhaps, that new media is finally positioned to take its place in education because the availability of easy-to-use production techniques are finally beginning to rival those in other communication vehicles like word processing. What appeared to have taken over five hundred years (from the invention of the printing press to word processing) has only taken video media a little over fifty to accomplish (Stephens, 1996).

The Medium is the Message, part 2

A second interpretation of the medium is the message concept is that the medium one uses to communicate not only helps to define the message, but also those who utilize that medium. The impact of new media in this manner can be demonstrated in several ways. For example, some researchers have looked at this interpretation and came up with the idea that increased usage and dependence on this form of media might be a two-way street. Two Stanford University researchers have looked into media interaction and examined the way people respond to media and media events. While we can readily apply knowledge gained from media experiences to real life, Reeves and Nass (1996) found that we also apply experiential knowledge gained from real-life to the use of media. Among other things, they examined cultural experiences like politeness, flattery, and negativity and found that people essentially react to media in identically the same ways they do to other people. First, their studies indicate that when a computer asks a user about itself, users will respond more positively than when a computer asks about how well another computer is doing. In other instances, people believe they did better on a computer-based test when the computer flatters them than when the computer offers no evacuation. Moreover, people seem to like a computer more, and believe it did a better job when it flatters them, whether or not the praise is warranted had no effect. Third, people were found to pay attention to, and remember negative media better than positive media. Additionally, people were found to have a better memory for information that follows negative media than for information that follows positive media and vice versa. Lastly, Nass and Reeves showed several instances when media personalities are more often identified solely through the media roles they play, to the extent where they cannot cause people to identify them by their real names. Perhaps what the *media equation* is telling us is that we need to broaden the context of what it means to be literate to new forms of media and to relate to media just as if it is a real agent in our daily lives.

The Role of Media in Education

In spite of these findings, researchers and educators looking into the intrinsic instructional value of video media have presented conflicting views with regards to the role visual perception plays in attention, motivation, and recall. There have been several studies that looked into the potential benefits mediated coding systems have on cognition (Davis, 1999; Nugent, 1982; Paivio, 1986; Seidman, 1981; Walma van der Molen, 2000). On the other hand, early theorists have had little good to say about television's ability to bring anything new to the table with regards to using it as an educational medium (Berlo, 1960; Calvert, 1989; Ide, 1974; Kozma, 1986). This may have been due to the limitations imposed by the technology in use at the time. Technological advances in commercial television production techniques that allow today's producers to readily integrate fast-cuts and montage have added to this benefit/conflict controversy by providing them tools to more easily communicate complex thought using a non-verbal narrative structure. A rapidly cut montage passage has been found to add clarity to a passage because the interpretive whole of the segment is more than the sum of its parts (Hitchon, 1994; Stephens, 1996). In other words, it is the composite whole of all the visual images in a passage or segment, considered at all once, that gives extended meaning to the montage. In addition, newer ideas on editing techniques have evolved that emphasize more the perceptual continuity of a non-verbal composite narrative structure rather than the classical point of view, which stressed the importance of applying strict editing rules in order to obtain smooth transitions between successive shots (d'Ydewalle, 1990).

Fast-seeing as Cognitive Activity

Studies need to be designed that will that will, hopefully, extend into an educational setting recent studies of casual viewers' ability to absorb and comprehend complex, rapidly-presented visual passages. What can educational video producers learn about presentation speed and editing from current commercial television production trends that incorporate an ever-increasing number of these fast-cuts and montage passages? Is it possible to recognize, recall, and get the gist of intellectual content solely from rapidly paced visual montage that is not supplemented with some form of verbal narrative? How does one's learning/cognitive style effect his or her ability to process fast-cuts/montage video presentations in a classroom setting? Most of the previous studies into the impact of fast-cuts/montage have concentrated on commercial television viewing (Bryant, 1991; Lang, 1998; Lang, 1999; Lang, 2000; Zillman, 1991). While there have been occasional studies (Keller, 1976) into the use of fast cuts/montage in an instructional setting, they have looked at viewers as a collective whole with little regard for differences in audience personalities, capabilities, cognitive style, or personal traits. Further, the subjects of all earlier studies in either setting have been college-level students enrolled in communications classes (Keller, 1976; Lang, 1999; Lang, 2000; Reeves, 1996), rather than school-aged students viewed in their original educational environments.

Construct-related Validity of Leisure-time Studies

Media researchers have looking into the benefits of rapid presentation have had to contend with a conflicting view that holds that the relatively fast presentation speed of televised programs creates an environment that may be detrimental to attention and recall (Alwitt, 1980; McCollum, 1999; Neuman, 1976). To the contrary, others have shown that presentation speed and rhythmicity in leisure-time media can actually heighten enjoyment, enhance motivation, and can "play an important part in determining the affective or emotional response of message receivers" (Seidman, 1981, p. 49). Intraub's (1999) recent studies into conceptual masking have shown that humans are able to recognize and recall pictorial presentations when a minimal amount of lag time separates individual images. There are those who believe that there have been several successes with childrens' programs that offer rapid and rhythmical presentation speed (Anderson, 1979; Anderson, 1983; Anderson, 1988; Pearl, 1982). Moreover, it appears that there exists a direct link between one's ability to comprehend televised messages and, in fact, overall academic achievement and one's innate cognitive (i.e. personal) tempo (Flowers, 1995; Shaffer, 2000, August 19; Snow, 1965; Wagely, 1978). Others contend that presentation speed in instruction may add interest to otherwise uninspiring content (Canelos, 1986, January; Edgar, 1997; Hawkins, 1997; Hill, 1993).

Still others have looked into presentation speed as its own construct, comparing/combining it to/with arousing content (Lang, 1999; Lang, 2000). Further, Lang (1999; 2000) discussed the effect of adding interesting and arousing content as having a positive effect on cortical arousal and, therefore, recall and recognition. In additional studies, Lang (2000) alluded to future research that should continue to probe the shape of the relationship between presentation rate and recall and test even faster rates of edits to determine whether there is a point at which memory begins to decline. Her studies suggest that producers who want their messages to be remembered should create arousing messages that are slow or medium paced, or calm messages that are medium or fast paced. She concluded that producers should not create messages that are either calm and slow paced or arousing and fast paced (Lang, 2000). The current study will look into the effect of integrating increased message presentation speed directly into instructional messages in an educational environment whose content might be considered by some students as less than arousing. It should also be noted that Lang (2000) considered cuts to be *fast* if they changed at a top rate of eleven to twelve per thirty-second segment (i.e. one every 2-3 seconds). While these studies are important in their own right, perhaps their speed of presentation may not be fast enough, considering an observation by this author that current trends in television editing techniques tend to present images almost ten times as fast.

Lack of Correlation in Educational Settings

These investigations into the effects of casual television viewing have not translated too well to the educational setting (Salomon, 1994). As Kozma (1986, p. 14) had stated, "viewership should not be confused with learning". However, once one delves deeper into these studies, four possible reasons for this lack of generalizability become apparent. First, the reputation commercial television has held for being nothing more than an entertainment device has certainly hurt its reputation in educational circles and has caused detrimental pre-conceived notions about how viewers are to be properly introduced to televised content (Wetzel, 1994). Second, many of the schema used in commercial television are considered by some to be nothing more than prototypical, trite, and overly familiar formulas that reduce the attention and concentration because they have been over-learned (Anderson, 1979; Langer, 1979). In these cases, encounters with overly familiar information formats "lead one to revert to a mindless routine in which the material is ignored or receives a low level of attention" (Wetzel, 1994, p. 169).

This alleged over-familiarity with format has lead many educators to believe that viewers will have difficulty responding appropriately to educational televised presentations, unless some form of intervention is used (Wetzel, 1994). Third, in many studies into casual viewing, there has been a tendency to lump all viewers into a single category (Lang, 1998; Lang, 1999; Lang, 2000; McLuhan, 1964; Neuman, 1976; Tyner, 1998; Walma van der Molen, 2000). Classical instructional models tend to validate the value of segregating learners and classifying them by their individual differences (Gentry, 1998; Joyce, 2000).

The fourth, and possibly most important reason for the lack of correlation between studies of casual viewing and those performed in an educational setting is that the learning environment is thought to present a different set of circumstances - a different view if it were. This is based on the importance placed on the medium to be evaluated as to its unique ability to bring about some type of alteration of intellectual behavior or thinking process. Although many of the symbolic (i.e. intellectual) combinations found in non-verbal endeavors such as music, painting, and dance can be displayed directly on television, there has been some question as to the extent to which transformations in the thinking process are created in viewing, and whether any changes that might occur are of any significance (Ide, 1974). In other words, television has not been given credit for yielding any new intellectual construct of its own. Previous studies into the value of using television as a medium for intellectual change have demonstrated mostly *negative progress* (i.e. television does not actually *interfere* with learning, nor is it no less effective than other forms of media) (Thompson, 1996; Wetzel, 1994).

Rapid Presentation as a Construct

Although there appears to be a dirth of studies looking into the conflict/benefit of rapidly-presented visual images in educational settings, there does exist some research that clearly demonstrates the potential instructional value of video that is aided by a systematic variation of presentation speed of as a valid instructional strategy (Comstock, 1978). Intraub's (1999) experiments into individuals' ability to understand and remember briefly glimpsed images dealt with pictures that were not or only very loosely related. The use of montage implies that the pictures included are at least conceptually related. Intraub (1999) indicated that subjects might be able to hold more than one picture at a time in a conceptual buffer, so long as the "series was not too long" (p. 57), and the notion that the included pictures were related to one another. It appears that humans may have the ability to construct meaning from these types of presentations through the use of interpretive coding (i.e. the process by which meanings are put together from specific parts of visual communications). In describing his research in teaching Native Americans how to use film to communicate meaning, Sol Worth (1997) noted that the process of coding has been neglected in the study of most of the fine arts, including film. His comments appear to be alluding to the fact that the form of a medium might be what carries meaning. In an earlier attempt to extending this notion to television, Pearl (1982) discussed the relationship between form and content and admitted that it is the form (that is, the way it uses verbal and linguistic codes), not the content, of television that is unique. However, she also cautioned that form and content cannot always be distinguished - "no more than grammar and meaning in any verbal language can" (p. 24). However, she went one to say (Pearl, 1982) that some forms are unique to the medium and apply syntactical meaning only in the context of that medium. For example, slow motion is not real and its meaning must be learned. However, once learned, studies have shown (Barnett, 2000) that these formats become generally used by people in their own thinking (i.e. when one speaks of applying slow motion to a video message, it generally carries the same contextual or emotional connotation). The current study tries to apply the same logic to fast cuts and video montage to see if this presentation format can be interpreted in such a way so as carry the same or different implied meanings than slower paced messages.

Previous research into using presentation speed and movement in educational multimedia has been the subject of controversy in the literature (Downs, 1989). Downs indicated that there might be a new wrinkle on evaluating the findings: one must try to "determine if children are attending to motion but not expressing it" (p. 97). She alluded to possible future studies that should include additional cueing strategies to determine their effect on learning. Under very broad interpretation, the speed of message presentation of motion and edits/cuts may be considered a form of cueing (Lang, 2000). Previous research also referred to presentation speed in a similar way, referring to it as a message's domain "attribute" (Downs, 1989, p. 3). Salomon (1979) acknowledged that media attributes are that "within the mediated stimulus, possibly shared to some extent with other (forms of (sic)) media, and makes the presented information more comprehensible or better memorized by learners of particular characteristics" (p. 5-6). Under Salomon's definition, *symbols* include "most objects, marks, events, models, or pictures" (p. 29). It is assumed in this study that the rhythmic patterns afforded by fast-cuts are an *event*. Where the current study varies from Downs' is that it takes the interrogation of symbols and attributes to another level. The current study aims to show that rapid presentation speed (also referred to as fast-cuts) may be considered an invaluable attentional attribute of media and is, therefore, capable of being studied separately to discover its contribution to learning. In short, this study aims to determine to what extent the (rapid) presentation speed of video images either aids or interferes with learning, considering the changes that appear to be taking place in an ever-increasing mediacentric society. Another consideration is the way in which the effect on learning is to be measured. Mayer (1996) indicated that words might not serve as proper feedback format to visual motion cues. Archer (1965) proposed that other evaluative vehicles be designed that are more closely aligned with the visual processing because something may be lost in the translation to verbal. The current study will utilize a combination of verbal and non-verbal methods to evaluate its results that are more closely attuned to the visual perceptual process.

New Media, a new View of their Impact

Changes in media technologies create the need for taking a new look at it potential impact on education. Child development psychologists like Robert Dorman, Jr. (1984) have noted that it is no accident that tottlers learn more in their first five years than in any other time of their lives. The fact is that they perceive and process images very rapidly - at a rate that equals or exceeds a new one every 100-300 milliseconds. These observations beg the question as to what happens to this rapid learning process just about the time that a child enters his or her formal educative years. What do current educational strategies do to slow the learning rate down? Has previous research been hampered by a lack in technology to implement and subsequently evaluate rapid presentation as an instructional strategy? Some have expressed this opinion in the past. Loftus (1982) found only one doctoral dissertation, and no published work had taken place up to the time of publication of his review of the literature in 1984. The current author has found one more in a very recent research of the literature, and that one also took place before Loftus' work. The truth is, almost no research has been done in this area since then.

On the other hand, recent contemporary theories about fuzzy trace memory (Brainerd, 1990; Brainerd, 1994; Reyna, 1994) might be the key to looking at rapid presentation as an instructional strategy. Research has uncovered that as a child progresses through developmental stages, s/he begins to loose specific details of episodic memory, but general details of contextual information last much longer and actually become the sole extent to which a person recall previous events. Research into this child development phenomenon has alternately given rise to new thinking about human memory in educational settings. In short, fuzzy trace proposes that there might be two distinct memory tracks, one that deals with verbatim information, and another that tracks essential contextual (i.e. gist) information that aids in the process of synthesis and analysis. These studies have indicate that both verbatim and gist memory can be stimulated with very short bursts of visual stimuli. While verbatim memory might be subject to masking limitations, gist memory has been found to be much more durable. It is obvious that more work in this newly created field needs to be done before any specific changes in educational strategies can be made. However, successes in experiments dealing with numbers (Brainerd, 1994) and text (Reyna, 1994) are promising.

Summary

In spite of previous experiments into memory associated with rapidly-presented visual messages, the time might be right to revisit this field. We appear to be living in an age where information overload might be in vogue . Previous experiments were hampered by the lack of any stable technology to recreate for testing purposes in a consistent manner rapidly-presented visual imagery. That no longer appears to be problem. According to some, today's youth who live in this world not only appear to be attracted to the rapid pace, but also might have learned how to cope with it and utilize it as a more efficient way to take in information. Child psychologists studying right-brain activity (Shichida, 1993) have known for years that image training in infants produces remarkable mathematical and reasoning capabilities. In fact, the right brain can process cognition without any fixed memory. The right brain functions beyond one's consciousness. Processing rapid montage appears to be a right brain activity. In short, rapid montage video may be able to play a significant role in the learning process because it matches three essential elements of perception and learning:

- Frequency
- Intensity
- Duration

The rapid changes in visual stimuli have been shown to gain viewers' attention, and cause viewers to concentrate longer. Educational research may well benefit from discovering whether visual stimuli presented at an increased delivery pace can provide similar instructional outcomes in a more efficient and stimulating manner (Cobb, 1997). This is something that might be a more practical outcome measurement for using video media than achievement alone.

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Learners' Perceptions of Design Factors Found in Problem-Based Learning (PBL) that Support Reflective Thinking

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Abstract

Reflection involves active, persistent, and careful consideration of any belief or practice. It promotes understanding of underlying beliefs and application of new knowledge to new situations. Problem-Based Learning (PBL) provides the instructional mechanisms for prompting learner reflective thinking. This study found that young students perceived three factors as most important in supporting their reflection in PBL lessons: learning environment, teacher, and scaffolding tools. Reflective activities are described and implications for designing PBL discussed.

Introduction

Modern society is becoming more complex, information is becoming available and changing more rapidly prompting users to constantly re-think, switch directions, and change problem-solving strategies. Thus, it is increasingly important to help young students develop keen reflective thinking capabilities during learning that help them construct strategies for applying new knowledge to complex situations in their day-to-day activities. Reflective thinking helps learners develop higher-order thinking skills by prompting learners to a) relate new knowledge to prior understanding, b) think in both abstract and conceptual terms, c) apply specific strategies in novel tasks, and d) understand their own thinking and learning strategies (Hmelo & Ferrari, 1997). PBL provides learners with instructional mechanisms that can increase their reflective thinking while exploring authentic and ill-structured problems, participating in social interactions, and receiving coaching from peers and teachers (Albanese & Mitchell, 1993; Donahuse, 1999; Hmelo & Ferrari, 1997). This mindful stance toward learning is essential for efficient development of reflective thinking and ultimately knowledge construction. However, the research on factors that may affect reflection during PBL is limited.

Previous studies have sought to identify factors that influenced reflection by looking at the activities in which learners engage during the PBL process (van den Hurk, et al., 1999). These studies have identified factors that may encourage reflective thinking but it is still unclear which factors the learner feels prompts valuable reflection. Answering questions such as how do we support reflective thinking in a PBL environment requires identifying both the factors that might prompt reflective thinking and examining learner perceptions about those factors. Therefore, the purpose of this study was to identify factors that learners perceived as important in facilitating their own reflections during learning activities.

Examining research-based factors for prompting reflective thinking in a PBL environment would be helpful in several areas. First it would simplify the further analysis of factors prompting reflective thinking in PBL by reducing the number of variables. Second it would provide a meaningful and useful framework for discussing design factors that support learners' reflective thinking when participating in a PBL lesson in a classroom.

Theoretical Framework

What is reflective thinking? John Dewey introduced the concept "reflective thought." Dewey's most basic assumption was that learning improves to the degree that it arises out of the process of reflection. Dewey (1933) defined reflective thinking as "active, persistent, and careful consideration of a belief or supposed form of knowledge on the grounds that reflective thinking supports the belief or knowledge and the further conclusions one can draw about it. This cycle is determined by the production of changes one finds on the whole satisfactory or by the discovery of new features which give the situation new meaning and change the nature of questions to be explored".

Moon (1999) believed that reflective thinking is a chain of ideas that is aimed at a conclusion and is more than a stream of consciousness; whereas, Canning (1991) believed that reflective thinking was a behavior that involves active, persistent, and careful consideration of any belief or practice that promotes understanding of underlying beliefs and applying newly gained knowledge to new situations. These studies agree that reflective thinking includes the process of analyzing and making judgment about what has happened. Reflective thinking experiences are associated with increased motivation, willingness to take risks, enhanced self-esteem and independence.

Why is it important to support reflective thinking in a PBL lesson? We can find an answer in the characteristics of PBL. PBL provides an environment where learners encounter ill structured problem situations. In reality, PBL takes place in settings that are characterized by a great deal of ambiguity, complexity, variety, and conflicting values that make unique demands on the learner's skills and knowledge. As a result, learners in a PBL lesson are constantly making choices about the nature of practice problems and how to solve them. Learners must be able to change ill-defined practice situations into those in which they are more certain about the most appropriate course of action to pursue. Therefore, the ability to reflect while acting is necessary to maintain the essence of effective practice in a PBL lesson.

Prompting reflective thinking is especially important to young students because the students of this age are experiencing many developmental transits. Reflective thinking doesn't occur in middle-level students spontaneously. According to King and Kitchener (1994), reflective thinking has seven developmental stages. Reflective judgment is in the seventh stage and the term that they apply to the most advanced stage in their model. People in the seventh stage who have reflective judgment can acknowledge that there is no right answer and experts may disagree as to the best solution of a dilemma. King & Kitchener describe reflective judgment as similar to 'wisdom' that adults usually have. However, middle school students are in a different developmental stage than adults. The National Middle School Association reports that middle level students are in a transition period from concrete thinking to abstract thinking. Therefore, they need some supportive activities to prompt their reflection in order for them to make learning meaningful and active. Therefore, it is necessary to prompt reflective thinking for middle-level students who are in their concrete thinking stage.

How then, do we prompt middle school students' reflective thinking in a PBL lesson? Research suggests that various elements in PBL are related to prompting students' reflective thinking. Previous research indicates that tasks, teachers, instructional environments, and reflective thinking tools are key elements that support reflective thinking in PBL (Andrusyszyn, 1997; Lin, 1999; Moon, 199; Barrow, 1998). First, ill-structured, authentic, and complex tasks are known to promote reflective thinking. These features of the task help students think reflectively because they come from real-world experiences, have no single formula for conducting an investigation to resolve the problem, and require more information to understand the problem situation (Stepien & Pyke, 1997). Second, the role of teacher is important in prompting reflective thinking during PBL. According to Virtanen et al. (1999), both facilitating teachers and traditional teachers are effective in a PBL environment. A teacher who prefers facilitative activities may help learners by asking reflective questions while a traditional teacher explains or directs important reflective concepts to students (Moon, 1999; Virtanen et al, 1999). Third, flexible and active learning environments are also important in prompting reflective thinking during PBL. Effective PBL requires a relaxed atmosphere that can promote cooperative and collaborative learning and is conducive to students and teachers exploring misunderstandings together (Michale & Susan, 1998). Finally, the scaffolding tools are important in prompting reflective thinking during PBL. Andrusyszyn & Daive (1997) and Kinchin & Hay (2000) posit that there are three main types of tools that scaffold reflective thinking: reflective journals, guiding questions, and concept maps.

However, incorporating these factors into PBL may or may not enhance reflective thinking. Learners may perceive different factors in the environment as important in promoting their own reflection. Therefore, understanding how learners perceive the importance of each factor in prompting their thinking about their learning is important in designing effective PBL environments, which has, thereby, prompted the following research questions:

1. What are the factors that students perceive as prompting reflective thinking?
2. Which factor is perceived as the most important for prompting learners' reflective thinking?
3. Is there a significant difference between the derived factors?
4. Which elements or characteristics prompt reflective thinking within the derived factors?

Method

Subjects

One hundred and forty-four sixth through eighth grade students attending three different middle schools in rural Pennsylvania participated. Students were from 6 different classrooms; including 82 boys, 59 girls, and 3 who did not identify their gender.

Instrument

A survey questionnaire for measuring the perceived factors related to reflective thinking in PBL was designed by the authors based on the literature of reflective thinking. The instrument consisted of 10 items that were scored on a 5-point Likert scale from strongly agree (5) to strongly disagree (1). The survey was reviewed for content and face validity and then tested with a small sample of middle school children to establish readability. The Cronbach alpha reliability of the final survey was .890.

Data Source and Analysis

Quantitative data on the perception questions were collected prior to participation in Problem-based Learning lessons. Data were collected over a five-month period, between October 2000 and March 2001. Maximum likelihood extraction and varimax rotation method were conducted for the factor analysis, using the SPSS/PC+ statistical package.

Results

In response to the first research question, *what are the factors that students perceive as prompting reflective thinking*, three factors emerged from the data based using an Eigen value of 1.0. Based on the literature review about design attributes required for reflective thinking, these findings were encouraging. (See Table 1.) Three items (teacher explanation, teacher question, and authentic task) were in the same factor 1, five items (having freedom in class, working with a partner, working with an ill-structured task, having time to think, and drawing pictures) were in the same factor 2, and two items (answering questions and writing about my understanding) clustered in the same factor 3. The main characteristics of factor 1 appear to relate to the teacher variable, those of factor 2 appear to relate to the student learning environmental variable, and those of factor 3 appear to relate to the tool variable for prompting reflective thinking

Table 1. Factor loading of elements that prompt reflective thinking in PBL

Item	Item content	Factor 1	Factor 2	Factor 3
3	When my teacher explains how to solve difficult tasks it helps me think more about what I am studying.	**.909**	.104	.217
4	When my teacher asks me how to solve difficult tasks it helps me think more about what I am studying.	**.566**	.297	.398
2	Working on activities in class related to real problems on earth or in our society helps me think more about what I am studying.	**.388**	.385	.208
7	Having freedom in class to explore topics I am interested in helps me think more about what I am studying.	.181	**.600**	
5	Working with partners during classroom activities helps me think more about what I am studying.	.122	**.491**	
1	Working on activities in class that have many different answers helps me think more about what I am studying.	.247	**.475**	.360
6	Having time to think about a question before answering helps me think more about what I am studying.	.428	**.460**	.116
8	Drawing pictures to illustrate my understanding of a topic helps me think more about what I am studying.		**.451**	.225
10	Answering questions about a topic helps me think more about what I am studying.	.172	.137	**.782**
9	Writing about my understanding of a topic helps me think more about what I am studying.	.182		**.600**

In response to the second and third research questions, *which factor is perceived as the most important for prompting learners' reflective thinking and is there a significant difference between the derived factors*, the highest ranked factor mean was the student learning environment factor (Factor 2, M= 3.87), followed by the teacher factor (factor 1, M= 3.62) and tool factor (Factor 3, M= 3.21). See Table 2. A paired sample t-test analysis was carried out to compare the factor means scores in three factor groups. The paired sample t-tests indicated that there were significant differences between the factors. The mean score of factor 2 is significantly higher than that of factor 1 or factor 3 ($p< .01$). The mean score at factor 1 is also significantly higher than that of factor 3 ($p< .01$). This result shows that students perceive the student learning environment factor (factor 2) as the most significant factor to help think reflectively. The student learning environment factor included student-centered attributes such as more flexible atmosphere, time, and tasks, peer tutoring activities, and bursts of activities incorporating a drawing Therefore students perceive a student-centered learning environment as prompting more reflective thinking than a teacher-centered environment that provides questions and explanations from teachers or a simple supportive learning environment that includes reflective thinking tools such as questions or writing.

In response to the fourth research question, *what elements or characteristics prompt reflective thinking within the derived factors*, the highest ranked elements, both of a social nature and loaded to factor 2, were having freedom to explore topics in class (x= 4.10) and working with partners (x= 4.05). See table 3.

Table 2. Paired samples t-test for factors

	Mean	Std. Deviation	t	df	Sig (2-tailed)
F1	3.62	.80	-4.209	140	.000
F2	3.87	.62			
F2	3.87	.61	8.471	142	.000
F3	3.21	.92			
F1	3.62	.80	5.243	140	.000
F3	3.21	.93			

Table 3. Mean and standard deviation of question lists

Item	Item content	Mean	SD
1	Working on activities in class that have many different answers helps me think more about what I am studying.	3.706	.93
2	Working on activities in class related to real problems on earth or in our society helps me think more about what I am studying.	3.63	.99
3	When my teacher explains how to solve difficult tasks it helps me think more about what I am studying.	3.71	.90
4	When my teacher asks me how to solve difficult tasks it helps me think more about what I am studying.	3.52	1.03
5	Working with partners during classroom activities helps me think more about what I am studying.	4.05	.94
6	Having time to think about a question before answering helps me think more about what I am studying.	3.90	.82
7	Having freedom in class to explore topics I am interested in helps me think more about what I am studying.	4.10	.94
8	Drawing pictures to illustrate my understanding of a topic helps me think more about what I am studying.	3.59	1.07
9	Writing about my understanding of a topic helps me think more about what I am studying.	2.94	1.13
10	Answering questions about a topic helps me think more about what I am studying.	3.48	.99

Conclusions, Limitations, and Importance to Instructional Design

Students perceived three major factors as most important in prompting their reflective thinking; student learning environment, teacher, and tools, ranked respectively. Of further importance was that the social activities within the environment were ranked as most important, demonstrating the importance of social learning to students. Previous research on the collaborative learning activities support the importance of social learning (Koschman, Kelson, Feltovich, & Barrows, 1996). Although the kids "liked" the collaborative activities, their teachers found them to be inexperienced in group decision-making and collaborative learning. Further research is needed to investigate how to scaffold students for successful participating in collaborative activities.

Further research is also needed to examine how these three factors, student learning environment, teacher, and tools, interact with each other. Given that the student learning environment emerged as the most important factor, it is important to further refine and test the attributes of this factor. This process will help to determine whether there are other specific components in the learning environment that student perceive as prompting their reflective thinking.

The findings of this study have important implications on the design of problem-based learning environment so that they will prompt reflective thinking. Student-centered environments that have a more flexible atmosphere, and provide many venues for social learning may have a stronger impact on learner's perception on reflective thinking. This research raised implications about students' perceptions of factors that prompt their thinking and learning. Designing PBL that prompts reflective thinking and ultimately deeper learning can be achieved by better understanding learner perceptions about factors that prompt their reflective thinking.

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Older Adults Eager to Explore Cyberspace

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Abstract

This study compared two methods of computer instruction for older adults. Elder Computer Instruction was systematically designed and developed according to criteria established by both theory and research in andragogy. This instructional design took into consideration identified cognitive and physical changes that accompany the aging process. Traditional Computer Instruction consisted of generic computer instruction commonly used with adults of all ages. A checklist, the Criteria Checklist for Andragogical Principles, was developed to help instructional designers and educators assess the adherence of instructional materials to andragogical principles. The systematic process for instructional design detailed in the study should be of use to those involved in the design, development, and delivery of instruction for older adults. The study investigated the effects of both types of instruction on older adults' computer attitudes, frequency of computer use, and types of computer tasks performed. Participants in both groups completed the Attitudes Toward Computers Questionnaire that assessed six dimensions of attitudes toward computers. Participants receiving Elder Computer Instruction had significantly more positive attitudes in the dimensions of efficacy, interest, and utility. The Computer Task Frequency Survey was given as a pretest/posttest. Both groups increased in their frequency of computer use and types of computer tasks performed following instruction. There was a significant difference between the two groups in the e-mail task, with those who received Elder Computer Instruction sending more e-mail than those who received Traditional Computer Instruction. This study underlines the importance of designing instruction to meet the specialized learning needs of older adults.

Older Adults Eager to Explore Cyberspace

As people age, once-active adults often find their world gradually shrinking as they become less mobile due to physical impairments that affect walking and driving (Coughlin, 1999). The Internet, however, offers older adults new opportunities for communication and car-less access to religious services, cultural activities, and educational opportunities (Whelen, 1998). According to Czaja and Sharit (1998), if older adults are successful in acquiring basic computer skills, they will realize that their daily lives can be enhanced and enlivened by using technology. Because most older adults did not learn to use computers in school (Dunnett, 1998), or in the workplace, those who now want to use them must find sources for instruction.

Computer use among older adults is increasing rapidly. According to the U. S. Census Bureau (2000), 27.6% of adults over the age of 55 live in a home with Internet access. A survey by International Data Corporation reports that adults over the age of 55 account for more than 12 million Internet users, an increase of 106% over users in the same age group in 1999. By 2004, this age group is expected to comprise 20% of all new Internet users (Hoffman, 2000).

Although computers are becoming less expensive and easier to use, older adults still face the problem of acquiring basic computer skills. Morrell, Mayhorn, and Bennett (2000) surveyed 115 Web users and 266 Web nonusers between the ages of 40-92. More than 81% of the Web users reported that they had taught themselves to use the Web. The two primary reasons given by the nonusers for not using the Web were the lack of computer access and lack of knowledge about using the Web. Both groups indicated that they would like to have simple instructional materials to show them how to use the different features of the Web. Morrell and Echt (1997) point out that older adults who are interested in learning about computers often have to search for training opportunities or have to teach themselves to use computers. The instructional materials they use are often designed for much younger people.

Research indicates that adults learn best when the learning goal is articulated clearly and when they can apply their learning to real-life problems (Redding, Eisenman, & Rugolo, 1998). The necessity for taking into account the learner's readiness to learn, life experiences, self-direction, intrinsic motivation, and problem-solving ability, as well as the immediate value to the learner, forms the basis of the adult learning theory known as andragogy. One of the strengths of this theory is its adaptability to the uniqueness of learners and to various learning situations. Because the principles of andragogy can be applied to a variety of adult learning situations (Knowles, Holton, & Swanson, 1998), it is an ideal conceptual framework on which to base computer instruction.

The practice of teaching adults could be said to have begun with philosophers and religious leaders such as Confucius, Socrates, Plato, and Jesus. It was not, however, until the second half of the twentieth century that Malcolm Knowles integrated various adult teaching methods into an adult learning theory that is now called andragogy. Knowles (1990) found that andragogy was especially pertinent to computer instruction. He points out four characteristics of adult learners that should inform the design of computer instruction for adults. First, because adults have a deep need to know why they should learn something before they invest their time and energy, computer instructors should explain the purpose of specific computer functions. Next, instructors should start with adult learners' interests because adults learn best those things that they must know in order to perform tasks that are relevant to them. Instructors should ask learners to write their personal goal for computer use. Third, the instructor should find out the background experiences of the learners in order to give them choices based on their prior experiences. Instructors should administer a pretest survey to determine the computer tasks the learners have performed prior to the instruction. Finally, adults are self-directing and dislike having decisions imposed on them. For this reason, teachers should allow adults to figure things out for themselves. Teachers who become facilitators rather than directors of learning create a nurturing learning environment.

Researchers such as Czaja and Sharit (1998) and Jay and Willis (1992) found that experience with computers increases older adults' feelings of comfort with technology, competence with computers, and feelings that computers are useful. Redding, Eisenman, and Rugolo (1998) note that adults learn best when the learning goal is articulated clearly and when they can apply their learning to real-life problems.

In addition to the characteristics of the individual adult learner, the effects of group experience are also relevant. Because learning is a social practice (Knights, 1993), the communal dimension of learning should not be undervalued. Knights points out that groups can exert a powerful influence to advance learning. Dixon and Gould (1996) found that when older adults collaborated with others in a problem-solving situation, their cognitive performance was enhanced. According to Cahoon (1996), when members of a group learn computer skills together, they can share their skills and knowledge as they solve computer problems through informal interactions with other group members.

Statement of the Problem

As America's population ages, it has become increasingly important that older adults have access to computer instruction that will enable them to feel more included in our technological society (Morris, 1994). Furthermore, computer instruction should be designed specifically to meet their needs. This study focused on the need to design instructional materials and to develop both instructional and grouping strategies that were theoretically grounded in the principles of andragogy. This instruction took into consideration identified cognitive and physical changes associated with aging. These changes include changes in vision, hearing loss (White et al., 1999), and decline in working memory, which is the process of storing information that is necessary in order to perform certain cognitive tasks (Salthouse & Babcock, 1991).

Purpose of the Study

This study focused on the systematic design, development, implementation, and evaluation of instruction to address the needs of older adults. The purpose of this study was to compare two methods of computer instruction for older adults. The study investigated the effects of both types of instruction on older adults' computer attitudes, frequency of computer use, and types of computer tasks performed. In addition, the study considered the effects of grouping on the computer attitudes of older adults.

Elder Computer Instruction

A needs assessment was conducted among a representative group of 54 older adults (Lawton, 1999). The results indicated that this population perceived themselves to have the greatest performance discrepancy with regard to computer competencies when they compared themselves to other age groups. Next, computer instruction for older adults was designed. The instructional materials were tested in a field trial and then refined and revised based on feedback from participants in a posttest survey and a focus group.

Elder Computer Instruction was systematically designed computer instruction. It was based on criteria established from both theory and research in andragogy and cognition and was developed using a process called instructional systems design. According to Seels and Richey (1994), instructional systems design is an organized procedure that includes the steps of analyzing, designing, developing, implementing and evaluating instruction. Analyzing is the process of defining what is to be learned; developing is the process of authoring and producing the instructional materials; implementing is actually using the materials and strategies in context, and evaluating is the process of determining the adequacy of the instruction. The Dick and Carey (1996) model was chosen as the instructional design framework because it provides a strong, fundamental process of instructional design that incorporates learning theory research and practical application. The strength of this model, which provides a step-by-step process to design instruction, is that all design components work together systematically to produce effective instruction and evaluation. The components of a learning system are made up of the learners, the instructor, the instructional materials, and the learning environment. The focus of a systematic instructional design is on what the learner is to know at the conclusion of the instruction (Dick & Carey). Design decisions based on data are particularly important in this model, thus the emphasis on needs assessment, formative evaluation and field trials.

Traditional Computer Instruction

Traditional Computer Instruction is generic computer instruction commonly used with adults of all ages. It was not specifically designed for older adults. Lectures were used to teach the history of computers, the purposes of computer systems, the functions of computer hardware, the importance of a comfortable working environment, and the use of computer terminology. Hands-on activities, beginning with lower level skills, were used. Activities were modeled, but in some instances learners were not given time to practice the activity. The computer manual contained the same information as the lecture and was uniform for all adult age groups. Most of the instructions were given orally. No memory aids in the form of written step-by-step directions were provided. Learners were instructed to use the "help" function on the task bar if they forgot a computer application.

The two instructional methods compared in this study shared the same terminal goal, that of enabling older adults to develop basic computer skills. The differences in both the instructional content and the teaching strategies in the two methods, however, were considerable.

Methodology

A quasi-experimental design was chosen as the framework for this empirical study. According to Huck and Cormier (1996), the most frequently used quasi-experimental design is the nonequivalent control group design. The group using Elder Computer Instruction was the treatment group; the group using Traditional Computer Instruction served as the comparison (control group). This study utilized the nonequivalent control group design because of the availability of pretest data and the fact that participants were not randomly assigned to the comparison group.

Instructional Environment

The six computer workshops for the treatment group (Elder Computer Instruction) were held in the same computer lab located in the Educational Technology Training Center at a local university. Each workshop was conducted on a Saturday from 9:00 a.m. until 3:00 p.m. with an hour for lunch. In addition, a morning and an afternoon break were included in the schedule. Participants were encouraged to take any extra breaks that were necessary. Every effort was made to ensure that participants were comfortable. In addition to the instructor, at least two facilitators were present in each workshop to provide individual instruction and to answer participants' questions. Participants were encouraged to ask questions at any time during the instruction. The lab was well lighted with adequate space and was furnished with adjustable chairs on rollers. Although the 17 computers in the lab were located in close proximity, there was enough space at each workstation for participants to work comfortably. Computers were networked to one printer and equipped with Windows 2000. All computers had Internet access. The lab also contained a teaching station and a smart-board projection system. Each participant was provided with a computer manual and a diskette.

The comparison group (Traditional Computer Instruction) attended computer classes held in a computer lab at a local technical college. The class met for two hours on Tuesdays and Thursdays for two weeks. Total instructional time was eight hours. The computer lab at the technical college was spacious and well lighted. The 18 computers in the lab were located on wide tables, and the adjustable chairs were equipped with rollers. A white board at the front of the room was provided for the instructor's use. The lab contained a teaching computer that could be projected onto the screen at the front of the room. The computers were networked to one printer and equipped with Windows 2000. The computers did not have Internet access. The instructor provided both group and individual assistance, as there were no facilitators to assist in the instruction. Each participant was provided with a computer manual and a diskette.

Participants

The 93 participants in this study consisted of older adults who ranged in age from 55 to 85 years of age with a mean age of 68.4 years. There were 25 males and 68 females. Participants were divided into three groups: an existing group, a newly formed group, and a comparison group. Thirty-seven participants were volunteers who were members of three different existing groups. Two groups were from area churches, and one group consisted of a sorority for professional women. This group consisted of 9 males and 28 females with a mean age of 69.1 years. Twenty-seven were Caucasian and 10 were African-American. These participants were previously acquainted and shared commonalities.

There were 45 participants in the newly formed groups. They were acquainted with few, if any of the other participants prior to the computer workshop. These participants were recruited from advertisements in the newspaper, fliers in area grocery stores, advertisements in senior centers, advertisements at a local hospital that provides senior activities, and word-of-mouth referrals. This group consisted of 12 males and 33 females with a mean age of 67.8 years. Thirty-five were Caucasian and 10 were African-American.

The participants in the comparison group began with four males and eight females. One female dropped out after the second session. The remaining participants had a mean age of 68.6 years. All were Caucasian. These participants were enrolled in a basic computer class through a continuing education program at a local technical college. All volunteered to take part in the study. The number of participants was determined by course registration with the intent to compare groups of approximately equal size.
Instructional materials designed for this study were compiled in a computer manual entitled Seniors Surf Into the Twenty-first Century. These materials, first used in a field trial, were developed following the model in The Systematic Design of Instruction (Dick & Carey, 1996). This development process included formative and summative evaluation that was used to revise the instructional materials, making them more efficient and effective. A checklist, the Criteria Checklist for Andragogical Principles (Lawton, 2001), was also designed to assess the adherence of instructional materials to the principles of andragogy (Caffarella, 1993; Cross, 1981; Knowles et al., 1998; Pratt, 1993). This yes/no checklist asks evaluators to assess three major components of instructional design: instructional strategies, design of instructional materials, and design of the physical learning environment. Evaluators then cite evidence and/or concerns for the application of each principle in the space provided on the checklist.

Data Collection

Quantitative data for this study were collected in the following ways. At the beginning of the instruction,participants for both the treatment group and the comparison group were given the Background Demographic Survey. Learners were given the Computer Task Frequency Survey (Lawton, 2001) as a pretest/posttest to determine differences in computer frequency and types of tasks performed between the groups. Although there were differences in the administration of the pretest (which was print) and the posttest done via phone eight weeks following the instruction, the administration was the same for both the treatment group and the comparison group. Participants in both the treatment group and the comparison group completed the Attitudes Toward Computers Questionnaire (ATCQ; Jay & Willis, 1992). This 33-item multidimensional measure assesses six dimensions of attitudes toward computers: comfort, efficacy, control, dehumanization, interest, and utility. Each of these dimensions is assessed by five or six items on a 5-point Likert scale format. A seventh dimension, gender equality, was not used in the present study. Response options range from "strongly disagree" to "strongly agree." The ATCQ has been used in prior research with older adults (Czaja & Sharit, 1998; Jay & Willis, 1992).

Data Analysis

Data gathered through the Computer Task Frequency Survey and the Attitudes Toward Computers Questionnaire were analyzed by a one-way analysis of variance. The purpose of the analysis was to determine whether or not there were significant differences at the $p \leq .05$ level in attitudes toward computers and types and frequency of computer tasks performed between the treatment and comparison groups.

Significant differences were found between the treatment group and the comparison group with the treatment group performing higher on three of the six dimensions: efficacy, interest, and utility. In the dimension efficacy, differences were statistically significant, F (1,92) = 6.204, p = .015. Analysis of the interest dimension revealed a statistically significant difference, F (1,92) = 7.904, p = .006. The dimension utility also had a statistically significant difference, F (1,92) = 5.534, p = .021. Analysis of the dimensions of comfort, control, and dehumanization did not reveal a statistically significant difference between the two groups.

When the attitudes of the participants in the existing groups and the newly formed groups (both of these groups received Elder Computer Instruction) were compared, there were no significant differences found. A comparison of the computer attitude of participants receiving Elder Computer Instruction according to age--the young-olds (ages 55-64) and the older-olds (65+)--revealed no significant differences in attitudes.

Two questions measured the frequency of computer use. Participants were asked how many times they had used a computer for any reason and how many hours per week they used a computer. While each group increased their frequency of use from the pretest to the posttest, the differences between the two instructional groups were not statistically significant.

The other nine questions measured the different types of computer tasks participants performed: using the mouse, changing the speed or size of the mouse pointer, moving desktop icons, playing solitaire, saving a document to a disk, sending e-mail, opening e-mail, sending an e-mail attachment, and using the Internet.

Analysis of the e-mail computer task revealed a statistically significant difference, F (1,92) = 6.067, p = .016, between the treatment group and the comparison group. Participants in the treatment group sent e-mail more frequently than did those in the comparison group. There was no statistically significant difference between the two groups in the other types of computer tasks performed.

Discussion

Results of data analysis support the benefits of systematically designed computer instruction for older adults. The findings indicate that the treatment group receiving Elder Computer Instruction demonstrated more positive attitudes on every attitude dimension than did those receiving Traditional Computer Instruction. In three of the six attitude dimensions, there were significant differences between the two groups. These three dimensions--efficacy, interest, and utility--have a direct relationship to the theory of andragogy. The participants receiving Elder Computer Instruction evidenced a significantly more positive attitude in the area of efficacy. According to the theory of andragogy, adults learn best when they are motivated to learn. They believe that they can learn new material (Knowles, et al., 1998). Elder Computer Instruction participants also evidenced significantly more positive attitudes in the area of interest. Another adult learning principle (Knowles,1990) is that adults are interested in learning what they need to know to perform a task. Finally, data analysis revealed a significantly more positive attitude in the dimension utility for participants receiving Elder Computer Instruction. The core principle of andragogy is that adults need to know why they should learn something before they engage in learning (Knowles et al., 1998). When adults realize how computers can enrich and enliven their lives, they will understand the usefulness of learning computer skills. The participants receiving Elder Computer Instruction appeared to have a greater appreciation of the usefulness of computers.

Conclusions

The distinguishing feature of this study is its focus on the importance and benefits of systematically designing computer instruction for older adults. The statistically significant differences found in attitudes were between the groups receiving different instruction. Neither group membership nor age appeared to have an effect on computer attitudes. The type of instructional method received by the participants appears to be a more important factor in shaping computer attitudes. It was observed during the instruction that members of newly formed groups receiving Elder Computer Instruction evidenced interaction and collaboration with other participants similar to that observed in the existing groups who were previously acquainted. Many participants who were not previously acquainted worked together to perform computer tasks. Participants who learned tasks quickly often checked to be sure that slower participants kept up with the instruction. During the e-mail activity, many exchanged e-mail addresses and e-mailed each other. New acquaintances chatted with each other during breaks and often went to lunch together. With the exception of two married couples, participants receiving Traditional Computer Instruction were not previously acquainted. These participants also worked together to perform computer tasks, helped each other with tasks, and became acquainted with each other during the instruction.

Knights (1993) notes that learning is a social practice, and group members often are concerned for each other. Findings suggest that older adults appear to be more aware of the advantages of collaboration and are often more willing to interact with others for assistance or support in learning a task than are younger learners (Dixon & Gould, 1996; Kazemek, 1997). It may be that when older adults have a shared sense of purpose such as learning computer skills, previous group affiliation becomes less important. Prior research also indicates that older adults often feel at a disadvantage when learning computer skills in a fast-paced class with younger learners (Dunnett, 1998; Redding et al., 1998; Timmerman, 1998). Both Elder Computer Instruction and Traditional Computer Instruction were limited to adults, ages 55 and above. Adults in both existing groups and newly formed groups expressed that they preferred computer classes made up of older adults.

This study describes the step-by-step process used to design instructional materials according to learning theory research and practical application. The research also provides new information regarding the relationship between the instructional materials used for older adults and their resulting attitudes toward computer use. When older adults receive computer instruction that is designed uniquely for their needs, they appear to develop more positive attitudes toward computers.

At the conclusion of one of the workshops in which the participants were members of an existing group, one participant confessed that she had once walked out of a computer workshop. "The instructor gave a detailed lecture on the inner workings of the computer. I went to the workshop to learn how to use the computer. I really did not care how it worked, so I left. I stayed for this entire workshop because it was practical. Now I believe that I can use a computer."

JoAnn, another participant, came to the workshop to learn to e-mail. She had traveled in China and discovered that she could have e-mailed her family from public computers at a nominal cost had she known how to set up a hotmail account. After the workshop, she traveled in Europe. She reported that not only had she used the hotmail account that she learned to set up during the class, she had taken her computer manual with her and taught a fellow traveler how to use e-mail.

Monira, originally from Lebanon, owned a computer prior to the workshop and regularly exchanged e-mail with her family in Lebanon. However, she had to wait for a relative or friend to come to her house and open her e-mail so that she could read it, and then send her responses for her. At the workshop, she learned to e-mail independently.

Loretta, another participant, told about her experiences in teaching English to a woman who had recently moved to the United States from South America. In addition to learning English, the woman wanted to learn basic computer skills in order to e-mail her family in South America. Loretta gave her a copy of the manual used in the workshop. Because it was written clearly and simply, a person with limited English could use it successfully.

One of the basic principles of andragogy is that adults learn best those things that they must know in order to perform tasks that are relevant to them (Knowles, 1990). At the beginning of one work shop, an 80-year-old participant confided that her grandchildren had asked, "Grandma, what's wrong with you? You can't e-mail." On the posttest survey eight weeks after the instruction, she reported that she was now e-mailing her grandchildren.

Since this study was the first to compare systematically designed computer instruction for older adults with more generic computer instruction commonly used with older adults, it provides ample opportunity for further research. There are still many older adults who need access to training facilities (Galusha, 1998). All interested older adults need the opportunity to explore the world afforded them by technology --not the least to facilitate those e-mails to their grandchildren.

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Online Students' Perceived Self-Efficacy: Does It Change?

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Abstract

Two types of self-efficacy were investigated in this study: self-efficacy for course content and self-efficacy for online learning technologies. Specifically, we examined how these two types of self-efficacy change throughout a semester. Secondly, we examined whether students' self-efficacy is predictive of their satisfaction and course performance. Three hypotheses were tested: (a) self-efficacy for both course content and online learning technologies change across a semester; (b) self-efficacy is predictive of student satisfaction with course; (c) self-efficacy is predictive of course performance. Participants were undergraduate students who enrolled in an online course at the University of Central Florida. In an attempt to longitudinally gauge the student's continuing self-efficacy, a self-efficacy survey for the course content and online learning technologies was administered every three weeks (four times across a semester). At the end of the semester, students' perceived degree of satisfaction with the online course was measured and students' final course scores were obtained from the instructor. Results indicated that both self-efficacy for course content and self-efficacy for online technologies increased during the semester. In addition, while initial self-efficacy for course content was a significant predictor ($p<0.05$) of students' satisfaction with the course, neither self-efficacy with course content nor self-efficacy with online technologies was significant predictors of performance.

Introduction

The development of telecommunications technology since the early 90's has led to an explosive growth in the World-Wide Web (WWW). According to the Ipsos-Reid (2001) and CyberAtlas's (2001) reports, as many as 400 million people are already on the Internet, and nearly one billion people (about 15% of the world's population) will be connected to the Internet by 2005. Along with the astonishing growth of Internet usage, an increasing number of educational institutions are now offering their courses via the Web, namely Web-based (online) education. International WHERE + HOW (2001) lists more than 55,000 online courses that are provided by higher educational institutions and training corporations. The benefits of online education are two-fold: individuals are given an opportunity to enhance their professional development and expand career opportunities while juggling responsibilities between family and work, and online education provides educational institutions a means to reach a greater student population resulting in an increase in revenue.

Although online education is gaining tremendous popularity, it is accompanied with a serious problem: a high attrition rate. Students enrolled in distance courses are more likely to drop out than their traditional counterparts. According to Moore and Kearsley (1996), the attrition rate in distance education courses is between 30 and 50%, which is much higher than in traditional course settings. This results in some negative implications for students, as well as for institutions. For students, the negative effects of dropout include loss of opportunity for personal and career advancement, lowered self-esteem, and increased likelihood of future disappointment (Atman, Egan, Sebastian, Welch, & Page, 1991). For an institution, high attrition rate results in considerable financial loss (Keegan, 1986).

Background of the Study

A great deal of research has been conducted to investigate factors that lead to student attrition (Baynton, 1992; Coggins, 1988; Dille & Mezack, 1991; Eisenberg & Dowsett, 1990; Fjortoft, 1995; Frew & Weber, 1995; Garland, 1993; Keller, 1999; Miltiadou, 2000; Parker, 1995; Pugliese, 1994; Zajkowski, 1993). Among those factors identified, motivation is often considered a strong predictor of success in a distance course (Baynton, 1992; Coggins, 1988; Dille & Mezack, 1991; Fjortoft, 1995; Garland, 1993; Keller, 1999; Miltiadou, 2000; Zajkowski, 1993). Keller (1999) directly attributes attrition to a motivational problem.

While learning takes place at a distance, student motivation becomes particularly critical because distance learning places the responsibility of learning on the student much more so than does traditional learning. Cropley and Kahl (1983) stated:

> "distance learners are thrown back upon their own motivational resources to a greater extent than is the case with face-to-face learners, since many of the factors which provide external motivation are absent or present only in an indirect form in distance education. Internal motivation is a highly desirable thing in face-to-face education, but is a necessary precondition in distance education" (p.32).

In numerous studies of learning motivation, self-efficacy has been identified as a significant predictor of student motivation (Bandura, 1997). Specifically, self-efficacy is predictive of academic performance and course satisfaction in traditional face-to-face classrooms (Bandura, 1997) and online courses (Miltiadou, 2000; Wang & Newlin, in press). Furthermore, an individual's self-efficacy has a significant impact on his or her (a) actual performance (Locke, Frederick, Lee, & Bobko, 1984; Schunk, 1981); (b) emotions (Bandura, Adams, & Beyer, 1977; Stumpf, Brief, & Hartman, 1987); (c) choices of behavior (Betz &

Hackett, 1981); and (d) amount of effort and perseverance expended on an activity (Brown & Inouye, 1978). Self-efficacy, as defined by Bandura (1997) is, "the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). According to Bandura (1997), four major sources contribute to an individual's self-efficacy: enactive experiences, vicarious experiences, verbal persuasion, and physiological indexes. Bandura (1982) reviewed a variety of self-efficacy studies in various settings, and found that self-efficacy theory has significant explanatory potential. He found that perceived self-efficacy accounts for a wide variety of people's behaviors, including changes in coping behavior produced by different modes of influence, levels of physiological stress reactions, self-regulation, achievement strivings, growth of intrinsic interest, and choice of career pursuits. Similarly, Multon et al. (1991), in a meta-analytic review of thirty-nine educational studies, found that self-efficacy beliefs were positively related to student persistence and academic performance across a variety of subject areas, experimental designs, and grade-level. Bandura (1997) also found that self-efficacious students share similar characteristics: they participate more readily, work harder, persist longer, and have fewer adverse emotional reactions when they encounter difficulties than do those who doubt their capabilities. This led Bandura to conclude that it is one thing for an individual to possess the necessary knowledge and skills to perform a task, and quite another to embody the self-beliefs in continuing with the task at hand while facing obstacles.

In light of the research, it is legitimate to infer that, in order to be motivated and successful in an online course, students should possess high self-efficacy for the content taught. However, if examined carefully, having adequate self-efficacy for course content might not be enough to succeed in an online course. Students with high self-efficacy for course content might not feel confident in learning in the online educational environment. Participation in online learning requires the extensive use of online technologies. To succeed in such courses, students should be able to use technologies to access course materials, send and receive email, browse the Internet, and perform searches to locate information. Students with limited or inadequate computer experiences or skills do not feel efficacious enough to participate in online learning and this can lead to computer anxiety (Loyd & Gressard, 1984). While students are experiencing computer anxiety, more effort is expended learning the media rather than the subject matter (Davie & Wells, 1991). Consequently, if an individual is to be efficacious about learning in an online course, he or she should possess two types of self-efficacy. One is self-efficacy for course content and the other is self-efficacy for online technologies. Online students should not only feel efficacious about the course content, but they should also feel efficacious in using online technologies.

Currently relatively few studies have been conducted to investigate self-efficacy and its relationship to satisfaction and performance when learning takes place in the online learning environment (Miltiadou, 2000; Wang & Newline, in press). And, results from those earlier studies concerning the effects of online technologies self-efficacy are inconclusive. Online technologies self-efficacy was negatively related to student performance in Miltiadou's (2000) study, whereas it was positively related in Wang and Newline's study (in press). In addition, those studies measured self-efficacy only one time - at the beginning of a semester. However, self-efficacy, especially self-efficacy with online technologies, may fluctuate during the course of a semester. Previous research on computer self-efficacy has indicated that positive past experience with computers increases computer self-efficacy beliefs while negative experience with computers lowers computer self-efficacy beliefs (Ertmer, Everbeck, Cennamo, & Lehman, 1994; Hill, Smith, & Mann, 1987; Torkzadeh & Koufteros, 1994). Similarly, in a web-based course, students' success or failure mastering online technologies contributes to the fluctuation of their efficacy expectation. Because self-efficacy regarding online technologies can fluctuate through the semester, measuring self-efficacy one time can reduce the accuracy of predicting the impact of self-efficacy on student learning.

Purpose of the Study

In an effort to provide an in-depth understanding of student's self-efficacy and its effects on student satisfaction and performance, this study examined (1) whether students' self-efficacy regarding course content and online technologies change throughout a semester; (2) whether self-efficacy for course content and online technologies are predictive of student satisfaction and performance. Specifically, answers to the following questions were sought:

1. Does a student's self-efficacy for course content change across a semester?
2. Does a student's self-efficacy for online technologies change across a semester?
3. Does self-efficacy of course content and online technologies serve as a significant predictor of student satisfaction and performance within a web-based course?

Methods

Participants

A total of sixteen students attending the University of Central Florida (UCF) at Orlando participated in this study. These students were enrolled in an undergraduate course, Introduction to Educational Technology (EME 2040). This course was offered through WebCT (WebCT is the course management tool used at the University of Central Florida).

Instruments

- Self-Efficacy Instrument

  The Self-Efficacy Instrument measures two components of self-efficacy beliefs – self-efficacy for course content and self-efficacy for online technologies. A total of 27, 5-point Likert-scaled items were developed. The first three items measuring course content self-efficacy were generated based on Eccles and Wigfield's (1995) 7-point Likert-scaled items. The last 24 items measuring online technologies self-efficacy were developed based on Miltiadou and Yu's (in press) Online Technologies Self-efficacy Scale (OTSES). Each statement is preceded by the phrase "I feel confident..." For each item, students are asked to indicate their attitude from "Strongly Disagree", "Disagree", "Neural", "Agree", to "Strongly Agree."

The instrument was tested by a pilot study conducted with thirty-two students during Spring 2001. Reliability analysis (Cronbach's coefficient alpha) showed that the reliability was .87 for the first three items measuring content self-efficacy and .90 for the rest 24 items measuring online technologies self-efficacy.

- Student Satisfaction Instrument
  In this study, student satisfaction with the course was measured by an attitude questionnaire that was administered during the last week of Summer 2001. This satisfaction instrument consists of 19 items measuring students' self-r reported level of satisfaction with the online course. Specifically, the attitudes instrument measured students' self-reported level of satisfaction with the course materials, instructor, and the online technologies. For each item, students were asked to indicate their attitude from "Strongly Disagree", "Disagree", "Neural", "Agree", to "Strongly Agree." In a pilot study conducted with thirty-two students during Spring 2001, reliability analysis (Cronbach's coefficient alpha) indicated that the reliability was .93 for these 19 items in this instrument.

Procedures

Participating students were asked to take an online survey (Self-Efficacy Instrument) at four intervals during the course of the Summer 2001 semester. Every three weeks, students were asked to fill out an online survey measuring their course content self-efficacy and online technologies self-efficacy. Along with the fourth survey (the last survey), a satisfaction survey (Student Satisfaction Instrument) was administered to measure student's degree of satisfaction with this online course. In addition, with students' permission, their final course scores were obtained from their course instructor.

Two statistical analyses were employed in this study. First, a doubly multivariate repeated measures analysis of variance was used to examine whether self-efficacy for both course content and online learning technologies changed across a semester. Second, multiple linear regression was used to determine if course content self-efficacy and online technologies self-efficacy could predict satisfaction and performance.

Results and Discussion

The results of this study showed that there is a statistically significant change ($F_{6,10} = 4.4$, $p = .02$) in self-efficacy for course content and self-efficacy for online technologies during the semester. Almost 73% (72.5%) of the change in combined self-efficacy can be accounted for by the time interval. Both self-efficacy for online technologies ($F_{3,45} = 7.72$, $p < .01$) and self-efficacy for course content ($F_{3,45} = 5.06$, $p < .01$) changed over time. Within subjects contrasts showed that self-efficacy for online technologies increased significantly ($F_{1,15} = 5.64$, $p = .03$) during the first three weeks of the semester (between time 1 and time 2). Although the respondents' confidence level with online technologies increased after the second time, neither the increase from the second time to the third time nor the increase from the third time to the fourth time was statistically significant ($p < 0.05$). On the other hand, within subjects contrasts using self-efficacy for course content showed a non-significant decrease ($p > .05$) from time 1 to time 2, a statistically significant increase from time 2 to time 3 ($F_{1,15} = 5.4$, $p = .04$) and a statistically significant increase from time 3 to time 4 ($F_{1,15} = 6.67$, $p = .02$). These results are displayed in Figures 1 and 2.

Figure 1

Self-Efficacy for Online Technologies

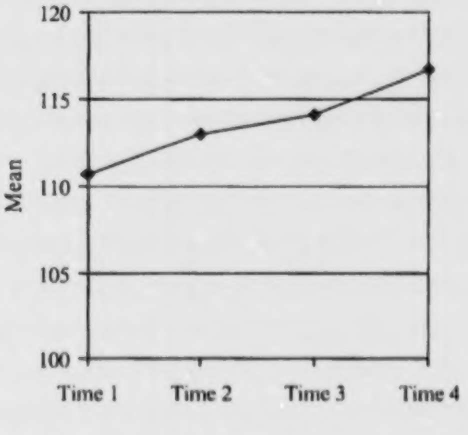
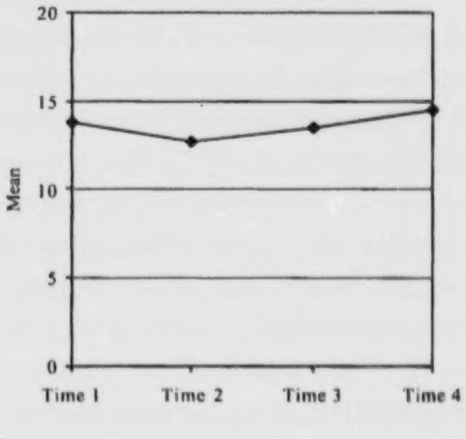


Figure 2

Self-Efficacy for Course Content



The results suggest that self-efficacy for both course content and online technologies is dynamic, indicating that self-efficacy is subject to change, even within a relatively short period of time (i.e. three weeks). A considerable change found in this study was the significant increase in student's level of self-efficacy for online technologies during the first three weeks of the semester. Commonsense dictates that, when students have more experience with online technologies, they feel more confident in using online technologies, and their self-efficacy increases, accordingly.

In predicting student's satisfaction with a course using the initial self-efficacy measurements, only course content self-efficacy was a statistically significant predictor ($t=2.77$, $p<.02$). This predictor alone accounted for 32% of the variance in satisfaction. When, however, a composite of self-efficacy for course content and self-efficacy for online technologies was used, the initial composite was a statistically significant ($R= .71$, $F_{2,13}= 6.7$, $p= .01$) predictor of student satisfaction. The resulting equation, Satisfaction = -2.89 + .4 (Online Tech) + 3.49 (Course Content), indicated that as self-efficacy increased for either online technologies or course content there was a resulting increase in satisfaction. Although initial self-efficacy for online technologies was not a significant predictor of satisfaction, more than 50% of the variance in final course satisfaction could be explained by the initial composite of online technologies and course content self-efficacy. By the third time period, self-efficacy for online technologies was a statistically significant predictor of satisfaction but self-efficacy for course content was not ($R= .74$, $F_{2,13}= 7.9$, $p< .01$). Overall, these results indicated that when these two types of self-efficacy were compounded, the possibility of predicting student satisfaction was increased. Consequently, we concluded that these two types of self-efficacy play substantial roles in predicting satisfaction.

Finally, the findings of this study showed that neither self-efficacy for course content nor self-efficacy for online technologies were statistically significant predictors of student performance until the fourth (last) time period. The resulting equation, Performance = 114.4 - .48 (Online Tech) + 2.99 (Course Content), indicated that as self-efficacy for online technologies increased, performance decreased; and as self-efficacy for course content increased, performance increased. The linear composite of self-efficacy for course content and for online technologies explained 40.1% of the variance in performance ($R= .63$, $F_{2,13}= 4.4$, $p< .05$).

Contrary to previous studies (Miltiadou, 2001; Wang & Newlin, in press), this study showed that initial self-efficacy for course content and online technologies was not a statistically significant predictor of student performance. The absence of a relationship between initial self-efficacy and performance might be due to the small sample size. However, in the last time period, a relationship between self-efficacy for online technologies and performance did appear. It is noticeable that the relationship was negative, indicating that students who were not efficacious with online technologies perform better than those who were efficacious. This finding corresponds with Miltiadou's (2001) study. A possible explanation for this phenomenon is that when online technologies were perceived as difficult and students were not confident in learning via this media, they were more likely to be cognitively engaged. However, when online technologies were perceived as easy, students seemed to expend less effort. Consequently, those who were efficacious with online technologies earned lower grades than those who were not efficacious. This phenomenon also appeared in Salomon's (1984) study, where the students considered learning from watching television easier than learning from reading printed text. These students exerted less effort, resulting in poor performance.

Although self-efficacy for online technologies was negatively related to performance, a positive relationship was found between self-efficacy for course content and performance. This was consistent with research findings from previous studies conducted in traditional classrooms as well as online courses where self-efficacy was positively related to student achievement (Bandura, 1997; Locke, Frederick, Lee, & Bobko, 1984; Miltiadou, 2000; Schunk, 1981; Nicholls & Miller, 1994; Pajares & Kranzler, 1995; Wang & Newlin, in press).

Conclusions and Suggestions for Further Research

With the growing popularity of online education and the urgent need to curb the online attrition rate, understanding and fostering online students' motivation is imperative. This study investigated self-efficacy, a critical element of motivation, and identified its effects on satisfaction and performance. Although the small sample size of this study limits its generalizability to the larger population, the findings of this study revealed some important points: (a) self-efficacy, both for course content and online technologies, changed over time in a web-based course, (b) the initial composite of self-efficacy for course content and online technologies was identified as a significant predictor of satisfaction, (c) the final measure of self-efficacy with online technologies was identified as a significant predictor of performance (with a negative coefficient), and (d) the final measure of self-efficacy with course content was identified as a significant predictor of performance.

Given the findings of this study, there appear to be several implications for researchers and instructors in the field of online education. First, this study showed that self-efficacy is dynamic and changeable within the course of a semester. However, in previous studies (Miltiadou, 2000; Wang & Newlin, in press), the dynamic nature of self-efficacy was often overlooked and was measured only one time in order to predict satisfaction and performance. This approach does not provide a comprehensive picture of self-efficacy and, accordingly, reduces the researcher's ability to explain the impact of self-efficacy on learning. In light of this, a genuine examination of the effect of self-efficacy on learning requires repeated measures of self-efficacy. When multiple measurement of self-efficacy is not feasible, it is imperative to specify the point in the semester when self-efficacy is measured.

Second, in past studies on self-efficacy, attention was predominately paid to efficacy expectation regarding the content learned, and yet participants' efficacy with learning tools or instruction delivery systems was often neglected. Nevertheless, in a web-based learning environment, participants' efficacy expectation with online technologies can no longer be ignored. As shown in this study, while predicting satisfaction and performance in a web-based course, participants' self-efficacy with online technologies was as critical as self-efficacy with course content. More attention should be paid to students' efficacy expectations while teaching or designing a web-based course.

Third, this study showed an unexpected fnding regarding the negative relationship between self-efficacy with online technologies and performance. Students who were confident with online technologies appeared to erroneously overestimate their abilities to deal with learning tasks, and thus exert less mental effort, which led to poor performance. To avoid the pitfall of faulty assumptions, students should be informed that no matter how proficient they are with the online technologies, participating in online learning requires no less effort than traditional classes.

The limitation of this study comes from its small sample size. In order to generalize the findings of this study, it is recommended that this study be replicated with a larger sample and with different types of classes in different academic settings (i.e. high schools, community colleges, and universities). In addition, the negative relationship between self-efficacy with online technologies and performance should be further explored. It is suggested that further studies look at whether students who are confident with online technologies do exert less mental effort in their online learning activities. This could unveil the mechanism that contributes to the negative relationship between online technologies self-efficacy and performance. Other studies could look at other possible predictors of student satisfaction and performance, such as task value, which has been identified as a significant predictor of both student learning achievement and satisfaction in traditional classes (Hammann & Stevens, 1998; Townsend & Hicks, 1995; Velayo & McKeachie, 1994). These findings could shed additional light into the prediction of student achievement and satisfaction in web-based courses.

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The Effects of Using Adult Learning Preferences for Trainers

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Introduction

This investigation examined whether or not the professional trainers could benefit from a needs analysis course in which real cases from various organizations were used and all the learning activities and materials were geared closely to the learning expectations and preferences of adults. Specifically, this study attempted to find out whether or not the use of five prominent adult learning preferences could enable the trainers to improve their (a) post-test achievement, (b) attitudes toward these preferences, and (c) performance in conducting individual needs analysis project. These preferences, which will be detailed in the methodology section, were derived from related literature on adult learning and included well-written, well-organized texts, lectures and handouts, and well-planned class discussions, reflections, and case studies.

Research questions of the study included: (a) were the use of the five adult learning preferences effective in helping the trainers comprehend and recall the needs analysis knowledge and therefore, perform better on the post-test? (b) were the use of the five adult learning preferences effective in helping the trainers apply the needs analysis knowledge and skills and therefore, be able to implement the individual needs analysis project correctly and effectively? and (c) what were the trainers' attitudes toward each of the learning preferences? In the following sections, related literature on adult learning characteristics and preferences is reviewed, which serves to provide a theoretical context for the study and to justify the rationale and the significance of the study. Then, the methodology of the study is detailed, and finally, the findings of the study, together with the implications of the findings, are discussed.

Adult Learning Characteristics and Preferences

Most literature on adult learning is theoretical, and theorists of adult learning believe that "forms of reasoning, thinking, and judging" of adults are qualitatively different from those characteristics of adolescents and children. This means, unlike adolescents and children, adults have more life experiences and are capable of building up a kind of situational reasoning to interpret their experiences and guide their actions during learning.

In providing a more comprehensive view concerning adult learning, Knowles (1980) pointed out that, adulthood should be defined as, when an individual is essentially responsible for his or her own life and is performing some types of acceptable social roles. Accordingly, adults, while assuming the role of learners, are different from child learners and possess distinct learning characteristics, which are qualities or traits of a person's learning. These distinct learning characteristics of adults include: (a) experience—adults often have rich life experience and are eager to find connections between new information and their experiences; (b) self-direction—adults enjoy directing their own learning and prefer to have freedom to choose their learning experiences based on their interests and/or needs; (c) readiness to learn—adults learn better when they are ready to or need to learn, and anticipate that the learning experience will match their expectations; (d) orientation to learning—adults prefer life-centered or task-centered type of learning versus subject-centered courses and want to apply what they learn in the classroom to real-life situations. Knowles (1984) also believed that adults are more motivated to learn by internal factors, such as increased self-esteem and confidence, than by external rewards like pay raises and job promotions.

In the past two decades, Knowles 's theory has been widely applied by other practitioners to discuss issues related to the learning preferences of adults. Learning preferences refer to the selection or choice of certain learning activities, situations or climates of an adult learner (Loesch & Foley, 1988). For example, Rosemary and Caffarella (1994) elaborated Knowles' theory and explained that adults not only have the need to examine and reflect on their past experiences and prior knowledge, but they can call upon these experiences and knowledge in formulating learning activities and in using them as learning resources. They believed that experiential learning activities, such as reflective journals, critical incidents, and portfolio development could be used to provide opportunities to help adults integrate their past and current experiences into the learning events. Rosemary and Caffarella further pointed out that, additional experiential activities, including field-based learning, small and large group discussion, role play, storytelling, metaphor analysis, case study analysis, and simulation are all effective in encouraging adults to engage in learning and communication with peers.

Other practitioners, including Charlton (1995), Collins (1999), Cross (1981), Dinmore (1997), Ference and Vockell (1994), Johnson (1995), Slusarski (1994), and Zemke and Zemke (1995), all provided suggestions for the use of various adult learning preferences to enhance learning. For instance, while presenting new information to adults, Cross (1981) suggested that: (a) one idea should be presented at a time to avoid overburdening the short-term memory of adults; (b) new information should be presented in an organized way that allows for mastery of the information and for the creation of relations between the new and previously learned information; and (c) frequent review and summarization should be made available to adults for assisting in retention and recall.

For enhancing abstract conceptualization among adults, Johnson (1995) recommended the use of a well-thought-out, well-presented lecture followed by a focused question and answer section. As for the design of learning situations, Collins (1999) suggested that the provision of structure and direction at the beginning of new activities are helpful to give adults a clear sense of what to expect from the learning journey. Charlton (1995) indicated that offering adults an interactive, performance-centered type of learning environment would be effective in helping adults integrate the new learning with their prior knowledge. Dinmore (1997) also pointed out that interdisciplinary courses that allow for the integration of knowledge derived in formal and informal environments are beneficial to adults. Ference and Vockell (1994) emphasized that adults like to take charge of their learning and are more self-reliant (1994, p. 25). They stated, "adult learners have often acquired their most successful skills through concrete, hands-on experience. They often prefer to continue this practice of learning by doing rather than by listening".

As for increasing adults' learning motivation, Zemke and Zemke (1995) suggested to: (a) make the content appeal to personal growth and gain; (b) describe the immediate and long-term relevance of the content to their lives; (c) stimulate curiosity about the subject matter; (d) ensure low risk for learner; and (e) explore the learners' positive and negative expectations. Finally, to promote adult's self-directing abilities, Slusarski (1994) agreed with other practitioners (Brockett & Hiemstra, 1991; Hiemstra & Sisco, 1990; Knowles, 1980, 1990; O'Donnell & Caffarella, 1990) that learning contracts can be effective in promoting self-direction among adults. Learning contracts that permit learners to " indicate what they will learn, how they will learn it, and how the learning will be evaluated" allow adult learners to plan subsequent learning activities in a more systematic way and therefore, grant them more control over their own learning.

In summary, theorists of adult learning believe that adults have distinct learning characteristics and preferences due to their rich life experiences. Adults learn when they are ready to learn and take pleasure in having self-direction during learning. They tend to build the newly learned information on their past experiences and prior knowledge. They are motivated by being able to see the relevance of the learning content and desire to link the new learning experience with their personal growth and gain. They want to have flexibility in choosing learning activities that are suitable for their learning needs and expectations. Finally, they prefer learning in a progressive manner and favor learning activities that are realistic, well-organized, and interactive.

Method

Research Design and the Participants

This study used the pre-test-post-test research design involving 53 trainers from an instructional analysis course at a north-eastern state university of the US. Among the 53 trainers, 17 were from the section of Fall II, 1998, 21 from Spring I, 1999 and 15 from Spring II, 1999. These trainers were all working full-time in local corporations, businesses, and educational organizations and were all enrolled as part-time graduate students. From the pre-assessment questionnaire, it was revealed that there were 41 females and 12 males with ages ranging from 23 to 50. Most of the participants had at least one to three years of training experience and had taken a course on the use of symptomatic models for training design and development.

Three major steps were included in the study. At the beginning of the class, in each section, the participants were given a pre-assessment questionnaire to gather data on their demographic characteristics, background in training and needs analysis, and their expectations in taking the course. A pre-test was then administered to measure their prior knowledge of needs analysis. After the pre-test, the participants then engaged in learning the knowledge and skills of needs analysis by using the five prominent learning preferences of adults. Throughout the learning process, the participants were expected to apply the content being studied to an individual needs analysis project. Successful completion of the project was required for passing the needs analysis segment. Upon completion of the project, the participants were asked to take the post-test and the attitudinal questionnaire to measure their post-test performance and attitude toward the learning preferences. The participants were not informed about the tests and the attitude questionnaire before taking them.

Learning Content and the Learning Preferences

The learning content included four human performance theories and models and five different data collection and analysis methods for needs analysis purposes. These theories and models included: (a) Allison Rossett's (1987) theory that seeks information to bridge the gap between the optimal and the actual performance, to examine feelings of performers or significant others, to identify causes of problems, and to propose solutions to the problem; (b) Robert Mager and Peter Pipe's (1970) Human Performance Model to examine performance discrepancies, skill deficiencies, and performance punishment issues; (c) Ron Zemke and Thomas Kramlinger's (1982) model to inspect the major human and organizational factors that affect people's performance in an organization; and (d) Thomas Gilber's (1978) theory and formula to calculate the ratio of exemplary performance to typical performance and to determine the potential for improving performance. The data collection and analysis methods included the design and conduction of interviews, focus groups, observations, questionnaires, and critical incident and document reviews.

The five adult learning preferences used were: first, an easy-to-follow textbook geared specifically toward needs and task analysis knowledge and skills, titled, "Figuring Things Out: A Trainer's Guide to Needs and Task Analysis" by Ron Zemke and Thomans Kramlinger (1982). Second, multiple sets of well-organized handouts that corresponded to the text and highlighted critical points of the learning contents. Both the text and handouts provided the participants with an organized means to learn the new and unfamiliar theories and skills of needs analysis. They also set directions for the learning sequences and allowed the participants to conduct frequent previews and reviews of the learning content.

Third, well thought-out and well-paced lectures were used to facilitate participants' conceptual understanding of the aforementioned theories and data collection methods. Also covered by lectures were real examples of needs analysis studies conducted in various organizations and how the knowledge and skills learned in the course could be applied both personally and professionally. Fourth, following lectures, class discussions were encouraged for the participants to ask pertinent questions, to share ideas with peers, and to stimulate critical reflections on the learning content. During discussions, all the participants were ensured a safe climate in which to exchange constructive information and prior experiences in the areas of training design, and needs analysis.

Fifth, a training performance related case in a business organization was used for the participants to analyze by applying the newly learned theories. The participants in each section were divided into four groups and each group was provided with detailed information about the case. Then, each group was assigned to use one of the four aforementioned theories to analyze the needs of the case. Upon completing the needs analysis for the case, each group had to present the analysis process, the conclusion, and the solutions for the situation. Each group was encouraged to provide reflections on the practice. This practice granted the participants to have an experiential activity that required the application of the newly learned theory to analyze training and performance issues in a real situation. It also permitted the participants to work in a group setting that had a specific goal to reach, was task-based, and needed to be interactive in order to complete the assignment.

More cases were created for the participants to have concrete, hands-on experience to collect, analyze and interpret the meanings of relevant data. Specifically, in this activity, the participants of each section were divided into two groups to analyze if there were performance related gaps or problems in the library and the computer lab of the university that they currently attended. Each group acted as if it were a focus group discussing its experiences in using the services provided by either the library or the computer lab. The discussion evolved around (a) if there was a gap between the service they received and the optimal service they would like to have had; and (b) if there was a gap, what caused it? Based on the results of the discussion, each group then designed a brief observational tool for conducting needs analysis in the library or the computer lab and developed a brief interviewing agenda with which to interview the staff of the library or the computer lab to gather more information. It was suggested that the groups try to create a situation or situations that would allow the group to observe the service provided by the library or the computer lab personnel. Based on the observational tool and interviewing agenda, each group gathered the needs analysis data. Finally, each group had to analyze the data collected from both the observation tool and interview, and recommend a solution based on the findings.

Research Materials

Research materials included a pre-test, a post-test, and an attitudinal questionnaire. All the research materials were developed by the researcher of the study and further reviewed by a colleague of hers, who had a Ph.D. in Instructional Design and Technology and had more than ten years of experience in conducting adult training. The pre-test contained eight open-ended questions, corresponding to the eight learning objectives for the needs analysis section. The wording was changed only slightly to present the objective in question format. Four of the questions covered the four aforementioned theories for needs analysis, and the other four included data collection methods. The post-test was identical to the pre-test except that the questions were presented in a different order.

The attitudinal questionnaire was designed to gather the students' perception of how helpful the used learning preferences were in learning and applying the course content, as well as, how much they enjoyed them. The participants were asked to rank them one through seven, with one being of the least assistance or least liked and seven being of the greatest assistance or the most liked. To avoid bias in the participants' responses and obtain a clearer picture of the participants' attitudes, the questionnaire also included questions on all activities used in the course including the text, lectures, handouts, class discussions and reflections, group-based case studies and presentations, final project, and a combination of all these activities.

In addition, the participants were asked about their perception regarding which activity was most crucial in helping them achieve certain learning outcomes. Specifically, these outcomes were: to recall the learning content, to explain the content to someone else, to analyze the content, to apply the content, to synthesize the content in a meaningful way, and to evaluate the value and usefulness of the content.

Data Collection and Analysis

The pre-and post-tests were scored using a predetermined answer key. A set number of points were assigned to each question based on the scope and difficulty of the question with the total possible points equal to 100. Answers were broken down into sections, and partial credit was given. A paired t-test was performed to determine if the results of the two tests were significantly different from each other.

For the needs analysis project, it is necessary that a needs analysis be based on a real performance or training related issue of an organization. Written guidelines detailing the purpose, procedure and expected outcomes of the final project were made available to the participants prior to the implementation of the project. There were five criteria used to evaluate each project and 20 points were assigned to each criteria. These criteria were: (a) the analyzed situation of an organization was clearly and completely described; (b) an attempt was made to analyze the situation by applying appropriate theory(ies); (c) a hypothesis was formed and effective data collection method(s) was (were) used to test the hypothesis; (d) an objective or scientific reporting of the collected data was included and data was accurately analyzed and interpreted; and (e) effective solutions/recommendations to bridge the performance gap or solve the problem in the situation was proposed.

Two analyses of variance, ANOVA, were first performed for ranking (a) how much the activities helped the participants in learning the content, and (b) how much the participants liked the activities. Once a significant F ratio was revealed by an ANOVA, the Tukey's test, with the total error rate of $\alpha=0.05$, was performed to determine which ranking means differed significantly from one another. Percentages of responses concerning how the learning preferences helped in reaching each level of learning (recall, comprehension, application, analysis, synthesis, and evaluation) were also calculated.

Results

The Pre- and Post-tests

A paired t-test was first performed to determine if there was a significant difference between the pre-test and post-test performance. The results revealed that the participants performed significantly better in the post-test than in the pre-test, $t(52)=34.19$, $p<0.0001$. The following Table presents the means, standard deviations, and differences of the t-test results for the pre-and post-tests.

Test	N	Mean	StDev	T	P-Value
Pre-test	53	3.00	6.19		
Post-test	53	79.64	16.58		
Difference		76.64	16.32	34.19	0.0000*

*p<0.0001

The Project Performance

All the participants performed very well in conducting the individual needs analysis project (mean=89.972, median=94.00, and St. Dev.=13.42). Table 2 lists the means and standard deviations of the participants' performance in reaching each criteria of the project.

Criteria	Mean*	Median	St. Dev.
Situational Description	18.214	19.000	2.521
Theoretical Analysis	18.337	20.000	2.706
Data Collection	18.393	20.000	3.240
Data Analysis and Interpretations	17.661	20.000	4.231
Recommendation of Solutions	17.321	18.500	17.800
Overall	89.972	94.000	13.42

Discussion

This study revealed a significant performance improvement from the pre-test to the post-test and an outstanding project accomplishment, which lend increasing support to the use of adults' learning preferences. These results suggest that the factors, which impact the professional trainers' learning and the application of the needs analysis knowledge and skills, are mutually dependent. It may be that a good text provided a systematic description of the covered content. Well-organized handouts called the trainers' attention to the most important aspects of the content. Well-thought-out and well-paced lectures further interpreted and analyzed the meaning of the content. Group-based discussion allowed the trainers to share their expertise and related experiences among themselves, and further increased their incentive to learn. Realistic case studies set up scenarios for the trainers to approach and analyze the case and therefore, invoked deeper understanding of all the important factors involved in each case. A combination of these reasons may have accounted for the trainers' success in increasing post-test scores, in doing a great job for the individual needs analysis project, and in developing a more positive attitude toward the combined use of the five learning preferences.

Also, from the results, case studies were perceived by some trainers to be helpful in comprehending and recalling the content. One reason for this may be that case studies demanded the trainers to put the newly learned information into practice and, therefore, empowered them to make a connection between the knowledge and skills gained, and their application. In addition, the project work was cited by most trainers to be effective in helping them apply, synthesize, and evaluate the learning content. It may be that a purposeful, individual project was effective to enhance self-initiation and the self-directing abilities of these trainers. With these abilities, they were able to derive more meaning from the process of accomplishing the project, thereby increasing the ability to apply, synthesize, and evaluate the content. Another reason is that these learning preferences were arranged in a progressive manner. The participating trainers were permitted to build their learning progress hierarchically due to this manner. That is, by the time these trainers were engaged in the project work, they had acquired all the necessary competencies in conducting the needs analysis project. Because of this, they felt more confident in finishing the project and felt that the project work was most beneficial in helping them accomplish most of the learning objectives.

Furthermore, a high level of learning motivation and professional interest held by these trainers may have contributed to their positive learning results. The participating trainers demonstrated their motivation to learn in many ways, such as attending classes regularly, engaging in group discussions, and participating actively in case studies. Most of them expressed concerns of conducting needs analysis studies on a trial-and-error basis in the past and were eager to acquire a formal education on the subject. While learning the subject, they truly appreciated the pragmatic nature of the subject, were very enthusiastic about the strong connection from theory to practice provided by the course; and were excited about the possibility of applying the acquired knowledge to their jobs. Therefore, the desire to learn came from within, and such a desire, eventually, made these trainers outperform.

Despite the positive results of the study, there were a couple of limiting factors involved in the study. First, the study did not provide an opportunity for the participating trainers to reveal how, and why, the combined use of the five learning preferences worked for them. For example, in what way did the five learning preferences help them have a successful construction of new concepts about needs analysis? To what extent did the use of realistic, open-ended case studies stimulate these trainers to apply the newly learned knowledge and skills? Second, this study did not investigate the long term effects of these preferences. Questions that need to be answered include: will the positive learning results acquired by these trainers be sustained over a long period of time? Will these trainers continue to achieve successful transfer of the needs analysis knowledge and skills?

Accordingly, for future research, it is necessary to use think-aloud interviews for the participants to discuss, in detail, how and why the use of adult learning preferences assist them to construct, internalize and apply the knowledge and skills of needs analysis. Researchers also need to determine the long term impact of using the preferences of adults to learn subjects with a pragmatic nature. In addition, questions regarding which adult characteristics and/or preferences should be integrated into the learning of different skills including psychomotor, verbal, cognitive, or attitudinal need to be answered. The examination of other factors such as levels of learning motivation, professional interests and needs, and prior knowledge and experiences, which all have impact on adult learning, is necessary.

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Teachers' Perceptions of Technology: Four Categories of Concerns

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Introduction

Today, many educational institutions have been challenged to integrate technology into their work settings. Technology is a mean of supporting goals related to increased student involvement with complex, authentic tasks within classrooms and schools (Scheingold, 1991). However, successful technology integrations are sometimes confronted with several difficulties, which include clients' resistance to change (Conner, 1992; Collins, 1991) or the lack of cooperation of the part of the people involved in that change (Kemp, 1996).

Recently, researchers argue that an innovation without considering clients' needs or concerns usually resulted in resistance to change (Ertmer, 1996; Hall & Hord, 1978; Dormant, 1986). The reason for this problem is a lack of attention to the clients' attitude, perceptions, and concerns that people form toward innovation. These concerns play an important role in the innovation process as well as in the inherent quality of the proposed change (Pershing, An, & Lee, 2000). Hence, identifying and addressing concerns and perceptions are an essential task of change agents during the whole innovation process. In this article, I will introduce a framework for analyzing clients' concerns and perceptions based on an information technology project that has been implemented in a seminary setting during the last five years. While conducting interviews with the teaching faculty members who participated in the information technology project at a seminary, I identified four categories of concerns. In this article, I will explain the characteristics of and interventions in each category of concern.

Context of the Case

In the mid 1990s a seminary in the Midwestern United States was awarded an externally funded grant for a technology initiative, which included developing instructional computing capabilities throughout the school (Saint Meinrad, 1995). The seminary hired two instructional interns to provide computer training to the seminary faculty and staff. At the beginning phase of the initiative, the interns conducted a training needs analysis. The main focus of the analysis was to gather information about the kinds of training programs faculty and staff members would need. Through the analysis, however, several concerns surfaced (Saint Meinrad, 1998). For example, the faculty members did not seem to think that computer technology was a tool useful for theology education, which emphasizes personal interactions within small groups. Administrators of the initiative, however, did not pay much attention to this perceived concern. They proceeded on the assumption that faculty members always complain about new initiatives, and they viewed such concerns as natural. They assumed that faculty members would eventually accept and use computers provided the faculty members received the proper training. With these assumptions in place, the administrators put effort into collecting and addressing training needs information while ignoring their concerns.

After the interns had provided in-service training for one year, they began to make informal visits to the classrooms, computer labs, library, and the faculty resource center. They found that many faculty members were not integrating computers into their teaching. According to the project implementation plan, almost all faculty members should have been using computers in their instruction after one year, since all the necessary facilities and training had been provided.

Faced with such resistance, the administration began to take the idea of concerns seriously. The administrators of the seminary learned it was not the lack of facilities or training, but concerns of the faculty that affected the success of the initiative. With this realization, they asked the interns to conduct a concerns analysis. One-on-one interviews and document analyses were used as data collection methods. All twenty-six teaching faculty and several administrators and staff of the seminary were interviewed (Lee, 2001). After conducting many rounds of card sorting, the interns identified four categories of concerns as below.

Category I: Concerns of Individual Incompatibility

Faculty perceived that the project was not compatible with their theological values or past personal experiences. These concerns had a critical influence in the earlier stages. Some faculty who understood and were well informed about the project, however, had not embrace it because of their perception of technology as opposing theological pedagogy. If they were not persuaded during the earlier stages, then it was hard to accept the project. Hence, this area of concern was critically important in the earlier stages of an innovation project, but its importance declined in the following stages. The following are several representatives of this area of concerns.

Conflicts of Needs between Institution and Faculty Regarding Technology A definite incongruence existed in needs between individual faculty and the seminary as a whole. The institution had emphasized that technology was the only tool to increase learning effectiveness in the information age. However, to the individual faculty, using technology was just one of many ways to improve learning methodologies. As one faculty pointed out, to accomplish the goal, it was not necessary to incorporate technology, because technology was not the only way to accomplish the goals. Furthermore, overemphasis on technology at the beginning stage of the project negatively influenced all faculty members.

Skepticism about Technology Ten faculty members among the 26 were very skeptical about technology. This resulted from their not being aware of the worth, potential benefits, or value of technology. Also, they were not convinced that technology was indispensable for their academic setting or their personal lives.

Paradigm Paralysis Fourteen faculty members out of 26 expressed this category of concern, which was the largest barrier to adopting technology among the faculty members of the seminary. This concern can be broken down into two sub-categories: the faculty's perception of technology as opposing theological pedagogy, and the faculty's comfort with current teaching styles. Faculty members thought that technology (or the information technology project) was basically incompatible with their theological context.

Theology, they argued, should focus on nurturing human nature, which is only possible with human interactions between instructors and students. In this point, they felt that their particular theological discipline could not adapt itself to technology because theological educators are suspect of the value of technology beyond the basics of classroom pedagogy. The other reason is that they believed their current teaching style had worked well for several decades, so there was little desire to take the time to change it.

Fear of Technology Nine faculty members expressed fear of technology in two forms: fear of the unknown and fear of the new. Some faculty were afraid something would go wrong with the computers. Most faculty said that they had not grown up in the technology culture. To them, technology was a foreign area. Even adopters of the innovation expressed concerns that technology had advanced so drastically that keeping pace with the advancement of technology seemed impossible.

Laggard Syndrome Nine faculty members perceived themselves as being far behind in using technology. One faculty who used technology in his classroom setting even expressed that he was at the knowledge stage, still trying to find out the benefits of technology.

False Information/ Irrational Belief Seven faculty members sympathized strongly with the criticism that technology is not a learning tool proper for the seminary. Some faculty mentioned that technology is a deterrent to human learning and communication. Those arguments were not based on scientifically proven facts but were based on personal feelings or subjective reflections. However, these feelings have not allowed them to see the potential benefits of the technology.

What are the effective interventions should be needed to address this category of concerns? Rogers (1995) indicated that person-to-person communication is important to address this area of concerns. Dormant (1986) also suggested that change agents should be counselors who draw out concerns, and listen to and clarify the adoption units' needs and interests. Hence, individual persuasion is a useful strategy to address this area of concerns by providing counseling and consultation sessions. The seminary realized that persuasion on an individual basis was the best strategy after noticing faculty's resistance to the innovation.

The seminary recognized that a core group was very skeptical about technology even after several years had passed since the innovation started. To identify their concerns, the seminary conducted one-on-one interviews with faculty members to become aware of the many issues that related to this area. The seminary stressed that Instructional Service staff were not attempting to change faculty's teaching styles, but to enhance their teaching styles with the use of technology. Also, the seminary published a monthly technology newsletter, both in print and on the intranet, featuring articles on the individual-incompatible area of concerns. Several faculty members wrote articles mentioning their successful experiences with technology in their teaching settings. The seminary provided opportunities for faculty members to visit other advanced technology -driven education institutes or learning opportunities to familiarize them with the practical applicability of technology in the seminary context. Also, more than ten faculty members attended technology -related seminars, conferences, and workshops.

Category II: Concerns of Unknown

Even when the value of an innovation is compatible with the target audience's values, the individuals of the adoption units may not accept the proposed innovation as planned for several reasons, including fear of the unknown and lack of information or knowledge required to implement the innovation. In the earlier stages, the individual faculty usually felt fear of the unknown or fear of lacking required knowledge or skills. The following are the typical examples of this category of concern.

More Work To eight faculty members, technology was one more burden that they had to learn. Technology adds or creates another task. Even faculty who used technology in the classroom expressed this concern most often. To learn technology was becoming increasingly stressful and time consuming for the faculty members.

Lack of Detailed Information about the Project The vision of the project was not address well to all faculty members. The lack of vision also made it difficult to set up the details for diffusing the innovation. Five faculty confessed that they were not aware of the detailed tasks in relation to the innovation. They expressed concerns about how technological innovations were to apply to the particular learning environment.

Teaching/Mentoring Concerns Providing individual teaching or mentoring was an effective means of adopting the technology by faculty members. Individual training was preferred over group sessions by the school faculty. Several reasons were expressed. The difficulty of finding a common time among faculty members and consideration of individual pacing were major reasons.

Time Conflict Eight faculty mentioned that time was one of the most important concerns in their not adopting technology. They said that technology was not a priority to them, for their primary responsibility was to prepare a class or preach. Some faculty had not even tried to learn technology because they worried about how much time would be spent.

Students' Unfavorable Attitudes toward Technology Students' unfavorable attitudes toward technology were also mentioned by two faculty members. Ironically, faculty members who had unfavorable attitudes toward technology mentioned that students showed the same phenomena. Two faculty expressed that students did not say that the technology helped them. That made some faculty not use much technology in classrooms.

Lack of Information about Good Applications Four faculty members said that it was hard to find someone who had applied technology very well. There was no easy way to identify other faculty members on campus who had already begun to use technology effectively in their teaching. And for most theological disciplines in particular, there was no comprehensive, easy-to-find source of information about relevant instructional applications of technology. While the number of locally successful models of educational uses of technology continued to increase, access to good descriptions of those models, training for them, and reports of their strengths and weaknesses were not easy to find.

The major strategy for addressing this category of concerns is learning, because usually these concerns can be overcome by providing well-organized training programs, job aids, and consultation programs. Also, providing correct information in a timely manner is another useful strategy to address this area of concern. However, the faculty's learning focus changed from general and basic issues of technology to more elaborate and complicated issues, such as transferring or applying the technology in more specific contexts in this case. This is why the learning format changed over time from the general group-based to the individual customized format.

To identify issues in this area and set up learning interventions, the seminary conducted a needs analysis project by conducting interviews with each faculty member as well as mailed surveys (Saint Meinrad, 1998). Based on these phenomena, several learning interventions were arranged in the seminary. First of all, an individual learning road map for each faculty member was developed. According to the road map, the well-organized technology training programs were provided for the following year. The interns had been working on-site on a weekly basis. After taking these programs for one year, the faculty improved their computer competencies from 2.5 out of 5 on the Likert scale to 3.1 in the same survey (Saint Meinrad, 1998). As the faculty moved deeper into the innovation, the focus of learning shifted to more individualized consulting and one-to-one training sessions. Also, remote consulting was offered by using electronic communication channels between the faculty and the outside interns.

To address time concerns, the seminary formed a committee to reorganize teaching loads. The recommendation of the committee was that the eclectic courses could be cancelled if few students enrolled, so the faculty could be learning at that time instead of teaching the course. Also, lack of time to learn was the most crucial factor in this category of concerns in this seminary. To address this concern, the seminary developed a training schedule that was flexible, meeting at different hours of the day, even evenings, so that the faculty could best take advantage of the offerings.

Category III: Concerns of Organizational Support

The organizational-compatible concerns were salient factors to be considered at the middle stage of the project at the seminary. Faculty who understood the benefits of the innovation did not adopt it because there were no organizational encouragements to do so. Many faculty members expressed concerns about the lack of organizational supporting systems and motivational systems. The following remarks are the typical expressions of this category of concern. The following are several representative examples of this category of concern.

Equipment and Maintenance Problems Several concerns were expressed in this category by seven faculty members. First, the faculty experienced difficulties when servers went down, especially after hours or on weekends. Some buildings were not equipped with technology. Not much software was installed in the Faculty Resource Center (FRC) or the Educational Technology Center (ETC), which made programs hard to access when needed. Services from maintenance persons were hard to find or untimely when computing problems occurred. Students may not have had support from the seminary to fix their computers if the computers had problems.

Students' Limited Access to Equipment and Support Services Three faculty members of the 26 mentioned that students' opportunities to access technology were limited. Not all the students' rooms and classrooms were wired. Some students could not access the technology, so electronic communication was sometimes impossible. Also, the computers in the student production center were so old that students could not use advanced software.

Students not Involved Three faculty members mentioned that students were not involved in the innovation from the start. It was directed to the faculty group only and it began without asking how students would learn or use the technology.

Lack of Organizational Benefits Lack of organizational benefits and motivational factors were mentioned by seven faculty members out of 26. The institution did not recognize the adopters of the innovation. Two faculty mentioned they might have adopted it if the institution had offered some motivation or incentives, such as monetary benefits. Suggestions of non-monetary benefits were also mentioned, such as vacations and training opportunities, and to lessen the teaching burden.

Distrust and Poor Communication Among Stakeholders There was little communication and coordination among stakeholders during the innovation diffusion process. The innovation initiators did not even try to gather ideas from the three constituent groups, faculty members, staff, and students, in order to make the most effective uses of technology, new approaches to teaching and learning, and other available resources in the seminary setting. Six faculty of the 26 expressed problems with innovation in this category.

This area of concerns is relatively easy to measure and to eliminate if addressed carefully and in a timely fashion during the innovation diffusion process (Fisher, Wilmore, & Howell, 1994). Traditionally, most change scholars have overlooked these concerns at the beginning. However, in order to lead a successful innovation project, the plan has to be reviewed regularly during the innovation process. Raising money, allocating resources, and providing technical and administrative support, including incentives or motivational systems, are essential elements.

These concerns can be eliminated by acquiring resources and equipment, providing timely technical and administrative support, providing incentives or benefit systems, and maintaining equipment. Foa (1993) pointed out that incentives, support, and reward structures are needed in order to make the efforts of the individuals more widespread and their results used more comprehensively. Major problems for the seminary lay in the institution's failure to provide motivation or incentives to encourage faculty members' active usage of the innovation. Many faculty suggested both monetary and non-monetary benefits and motivators, such as vacations, training opportunities, and a lessened teaching burden. While not providing any monetary benefits, the seminary provided many forms of non-monetary benefits, such as providing training programs and visiting other technologically advanced schools. The director of the Academic Computing Department became a member of the president's cabinet, a group of advisors to the president, and thus was directly involved in developing a new master plan, which included major renovations of several buildings over the next five years.

Category IV: Concerns of Organizational Incompatibility

Last category of concerns is related to the organizational incompatibility. Faculty expressed that the innovation was not compatible with the seminary culture. The seminary culture was oriented toward more human interaction, and focused on formation-building. Furthermore, the seminary was isolated geographically, as well as divided by disciplines. They also expressed their isolation regarding the innovation. The innovation was initiated in a top-down manner. They did not receive information in a timely fashion. Clear goals and directions for the innovation were not given to the faculty. Furthermore, faculty tended to work individually rather than in teams. Every faculty member understood the innovation differently. Hence, they perceived that two incongruent innovation diffusion tracks existed in the seminary: the individual faculty track and that of the institution. This concern began to increase in importance after addressing the individual-incompatible concerns, but increased strongly in importance at the implementation stage during the diffusion process. The following are several examples of this category of concerns.

Isolated Culture The cultural characteristics of the seminary, 4 faculty argued, were not compatible with technology. First, in preparing people for the ministry, the top priority of the seminary is fundamentally different than preparing people to teach in other higher educational institutions. The use of technology can be maximized mainly in the latter setting. Religious organizations such as the seminary must emphasize the value of forming and building relationships, which does not embrace technology. Hence, some faculty mentioned that technology was not a driving force at the seminary. Second, faculty had not grown up in a technology culture. Some faculty mentioned that the European learning model, which mainly uses lecture format in classrooms, had influenced the faculty members who had studied in Europe, who were the majority in the seminary. Third, the individuality of faculty members was another cultural characteristic. Most of the faculty pursued different disciplines and different areas of interest. That was the major reason why faculty were accustomed to working individually rather than in teams, which the innovation sometimes required them to do.

Class Characteristics Another reason for incompatibility originated from the class contexts that were small-group class setting and technology was not related the course content. Five faculty members argued that technology could not make an impact in a small class. Most of classes were populated by fewer than 10 students. In this situation, technology was ineffective for increasing learning. The other reason why the faculty did not utilize technology during class was their perception of the inability of the course to embrace technology.

Sharing and Showing Learning technology was one of the biggest concerns of the faculty members. Nine faculty members of the 26 expressed this type of concern. Sharing information about, or experiences with, technology among faculty was vital, and it could have been a strong influence on the faculty as a whole. Partly owing to a lack of vision for the innovation and to a lack of concrete examples of how to apply technology in a seminary setting, the faculty wanted to see other people's experiences and or knowledge.

Not Having a Clear Image of the Project Eleven faculty out of 26 expressed a lack of vision for the project from the beginning. This area of concern was the second largest barrier for the faculty. They argued that the innovation project was started by grant money rather than a vision. Without serious questions about why this innovation was needed in the seminary, the institution started the innovation, and this made it difficult for the faculty members to grasp the vision or purpose of the innovation.

Fragmented Technology Planning Five faculty members argued that the innovation was started without considering the necessity of information technology carefully in the context of Catholic pedagogy. They expressed that the innovation was focused on teaching rather than learning, and focused on media rather than methods. Two faculty criticized the innovation for starting in reverse order, selecting media (buying computers) without considering methods. One faculty mentioned that this project had missed one critical stage in the beginning: needs assessment or values clarification.

Collaboration was the most useful strategy to address this area of concern in the seminary. To address issues of this area, the seminary's geographical isolation, diverse faculty disciplines, and a top-down diffusion strategy, collaborative work among the faculty was essential. For example, creating a vision statement and sharing the innovation-related experiences with other individuals in the adoption units were helpful tasks in the seminary.

The seminary formed an ad hoc committee to set up a clear vision for technology and teaching at the seminary. The committee developed a vision with consensus from all faculty members and reported their findings to the faculty. Another intervention was to arrange several learning events in order to facilitate collaborative work among faculty members in the seminary. Through these events, faculty members shared their ideas with other faculty members. Sharing among faculty was the key activity for changing the seminary culture. These events included faculty presentation day, faculty learning day, small group interests, brownbag lunches and learning sessions. Also, through the funds from the grant, many faculty took advantage of conference opportunities to gain more knowledge about the appropriate use of technology. Furthermore, the seminary developed contacts with other schools facing the same issues and was able to find and demonstrate good practices in technology for theological instruction.

Concluding Remarks

Information technology is an effective means of increasing teaching and learning effectiveness in higher educational settings including seminaries. However, it must be well planned and organized before the project begins. Identifying clients' concerns and taking care of them are an important task of change agents during an innovation process. Setting up a vision statement, conducting perception analysis, and preparing detailed plans for the project would guarantee a successful implementation of an information technology project in a higher education setting.

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An Instructional Design Theory for Interactions in Web-based Learning Environments

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Introduction

Universities across the country are offering a growing number of courses on the World Wide Web. Many faculty and instructors are now faced with the challenge of teaching at a distance in a Web-based environment and are collaborating with instructional designers on how to effectively design Web-based distance education courses.

Teaching at a distance requires different strategies than those used in a traditional teaching environment. In traditional classes, interactions between learner and instructor and among all learners in a class are mostly synchronous. Often a lack of interaction has been considered a major weakness of distance education, blamed for causing feelings of isolation in learners who are situated all over the world with no or minimal face to face contact. Interaction between the learner and the course materials and resources can be hindered by new and unfamiliar technology. Nontraditional learners taking courses on the Web may not have the self-regulation or study skills to perform well in this environment. Interactions on each of these levels have been identified as a critical component for successful online learning (Hirumi & Bermudez, 1996; Moore, 1989; Roblyer & Ekhaml, 2000; Schrum & Berge, 1997; Vrasidas & McIsaac, 1999; Wagner, 1994), yet it can be extremely difficult for instructors to foster interactions in a distance environment.

Much of the literature regarding interactions in distance education has focused on the development and use of technology tools that permit interactivity or have focused on interactions as if they are the outcomes of instruction rather than the methods of instruction as pointed out by Wagner (1997). Little research has focused on interactions as instructional methods rather than outcomes.

An instructional design (ID) theory is a "theory that offers explicit guidance on how to better help people learn and develop" (Reigeluth, 1999). ID theories are prescriptive and design-oriented, identifying methods of instruction (including instructional strategies and tactics) and the situations in which these methods should and should not be used, based on the instructional conditions and desired outcomes.

The current study developed and formatively evaluated an instructional design theory to guide designers in selecting when and how to utilize interactions as instructional methods in a Web-based distance learning higher education environment.

Research Questions

1. What are the types and outcomes of interactions between participants in a Web-based learningenvironment?
2. When and how should these various interactions be designed into a Web-based learning environment?

Methods: Phase 1

Construction of New Instructional Design Theory

Phase 1 of the research methodology involved construction of the new instructional design theory. A type of formative research methodology, as described by Reigeluth and Frick (1999), was used to create and test this new instructional design theory. Specifically, we designed a particular case in which to develop the new theory. We chose an instructional situation (a Web-based graduate course) that we wanted our theory of interaction to apply to, helped to design the case (the course), and developed a tentative design theory in parallel. The case, therefore, became an instance of the theory.

The designed case was that of a Web-based distance graduate course in educational psychology at a large Midwestern university. The course is required for many programs in the school of education. The course is run entirely through a course management system on the Web. Both researchers were involved in the course design process, as recommended by Reigeluth and Frick (1999). By participating in the course design, it fosters "intimate familiarity with the case [which] is essential for developing good grounded theory" (p. 644). The design theory was developed in parallel with the course.

A five-member design team, including both the instructor and associate instructor, met once a week for approximately three months to design and develop the course. The researchers documented the design decisions and rationales as they developed the theory. This included documentation of intended learning outcomes; selection of methods, strategies and tactics; documentation of situationalities which influenced design decisions; and identification of the values behind instructional decisions.

The overall learning outcomes for this graduate course were for students:

- To become conversant with the basic assumptions, concepts and principles of each learning theory
- To determine the possible implications of each theory for instructional settings
- To be able to compare and contrast theories and their usefulness in the various settings of interest to the students in the course and other education professionals

- To create and revise a personal theory of learning

Throughout the design of the graduate course, we consistently documented our rationales for the selection of particular methods for particular learning outcomes, particularly as they related to use of interaction methods. We referred to the design notes to identify what the intended outcomes were for the method and extrapolated the instructional conditions and instructional outcomes.

The following procedure was used (Reigeluth, 1983; Nelson, 1998) to develop the theory in tandem with the designed case study:

Define the Purpose of the Theory

The purpose of this theory is to provide guidance for designers of Web-based graduate courses on when and how to utilize learner to learner, learner to instructor, and learner to resource and learner to self-interactions as instructional methods. Interactions as an instructional method contribute to the outcomes of the instruction such as team building, clarifying understanding, supporting learner control and enhancing elaboration and retention (Wagner, 1997).

Define the Values of the Theory

According to Reigeluth (1999), values "guide selection of goals and selection of methods" (p. 12). The values that guide this theory include:

- A belief that adults are most motivated to learn when they feel success, volition, value and enjoyment
- Higher-order thinking skills and complex cognitive tasks are best fostered by interacting with other learners to socially construct meaning
- Instruction should provide variety
- Instruction should foster creativity
- Instruction should be authentic and relevant to learners' lives
- Instruction be related to previous experiences and linked to prior knowledge
- Resources should be available to help learners with their tasks
- Activities should build on previous work done in the course
- Instruction should provide social as well as cognitive support
- All learners should have the chance to participate
- Cognitive overload should be avoided
- Learners should have responsibility for their own learning

Determine the Specific Domain, Situation or Scope of the Theory.

This theory addresses learning in the cognitive domain. It is applicable to learning situations with adult learners in higher education settings, particularly Web-based learning environments. The scope of the theory is specifically to provide guidance on when and how to utilize interactions as instructional methods that can be used effectively to attain cognitive outcomes.

Identify an Optimal Participant Interaction Process on which to Model the Theory.

The development of an optimal participant interaction process used in this study is based on previous experience of the researchers both as students and as researchers. This serves as a framework for the synthesis of the review of the relevant literature. The review of the literature can be seen as an initial formative research of the developing theory.

Moore (1993) points out that distance education is not simply a geographic separation of learners and teachers, but more importantly, a pedagogical concept. It is a concept describing the universe of teacher-learner relationships that exist when learners and instructors are separated by space and /or by time (Moore, 1993). From this separation, special patterns of learner and teacher behaviors that affect both teaching and learning are formed. The psychological and communications space of potential misunderstanding between the learners and instructors is called the transactional distance. The three sets of variables, which define the extent of transactional distance in an educational environment, are dialogue, structure and learner autonomy. 'Dialogue' can be translated as interaction, which places value on the synergistic nature of relationship of the involved participants (Moore, 1993). Based on this theory, interactions are even more important in distance environments than in residential environments, as when participant are separated by space and time the transactional distance is more difficult to overcome.

Vygotsky's (1978) understanding of learning as a social process is also critical to the discussion of distance learning theories. Various technologies and tools used for distance education create the context and setting where learning can occur. In Vygotsky's concept of the Zone of Proximal Development (ZPD), social interaction is crucial to the development of the new patterns of thoughts and behaviors.

The tools and signs the learner is exposed to play a great part in influencing or mediating the new patterns of thought and mental functioning (Werstch, 1991). Under the socio-cultural framework, what is meant by knowledge and learning is a change in perspective. If meaning must be personally constructed, then the learner is central to the learning process because personal experience determines reality. Hence, there is a need to consider instructional design from a more learner-centered perspective. Bonk and Cunningham (1998) incorporated the framework of sociocultural theory and principles for computer-supported collaborative learning (CSCL) environments. Compared to the cognitive constructivists' focus on making learning more relevant and building on students' prior knowledge, social constructivists emphasize human dialogue, interaction, negotiation, and collaboration (Bonk, Oyer & Medury, 1995). It is argued that social interaction and dialogue is central to learning. New skills and strategies first appear in a social place with adults and more capable peers in one's learning environment and are later internalized (Bonk, Appleman & Hay, 1996).

Thus, interactions among others in the learning environment are important to the learning process. Interaction itself can be defined as "sustained, two-way communication among two or more persons for purposes of explaining and challenging perspectives" (Garrison, 1993, p.16) or as "two-way communication among two or more people within a learning context, with the purposes as either task/instructional completion or social relationships building" (Gilbert & Moore, 1998).

Moore (1989) distinguishes three types of interaction in distance education: 1) Learner-content interaction. The learners are constructing knowledge through a process of accommodating new understanding into their cognitive structure; such interaction with content is one way to restructure knowledge. 2) Learner-instructor interaction relates to the assistance, counsel, organization, stimulation and support that the instructor provides to the learner in constructing new understanding of the content. 3) Learner-learner interaction is a kind of "interaction between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor" (Soo & Bonk, 1998).

In addition to the three types of interaction identified by Moore (1989), many researchers emphasize learner- to-self interaction as a fourth very important component in learning: 4) Learner-self interaction: participating in an internal dialogue with oneself. While some researchers emphasize the importance of learner-learner interaction, minimizing the importance of the time allocated to self-reflection during online education (Soo & Bonk, 1998), others note the importance of the inner-dialogue system, suggesting that the development of self-regulatory skills is vital to independent learning and instruction (Savery & Duffy, 1996).

All four types of interaction are vital for distance education, although each type may be most appropriate for different tasks and for learners at different stages of development (Moore & Kearsley, 1996.) An instructional design theory can help us make this determination.

Based on the literature it is clear that interactions have instructional value and that there are many ways of fostering such interactions in distance education environments. However, this literature falls short of being *prescriptive* in nature because little attention is paid to the situationalities in which the methods may be more or less effective. Nor does the literature address the relationship between the various types of interactions and outcomes. Thus our theory will focus on addressing situationalities in which the methods are best used.

Determine Goals/Outcomes.

Wagner (1997) identified thirteen outcomes of interactions that are relevant to the design of this theory. These include:

- To increase participation and engagement with the learning process
- To increase social engagement with others in the group. To develop communication. To receive feedback
- To enhance elaboration and retention
- To support learner control/self-regulation
- To increase motivation
- To negotiate understanding. To build a team
- To discover
- To explore. To clarify understanding intended
- To gain closure

The development of our theory included an investigation of how these various outcomes were attained through the four types of interactions.

Develop Methods, Strategies and Tactics.

This theory focuses on the use of four methods of interactions: learner to learner, learner to instructor, learner to content and learner to self.

Determine Conditions/Situations.

Situations are "aspects of the instructional context that influence selection of methods" (Reigeluth, 1999, p.8). If any element of the situation changes, the instructional methods may need to be changed as well. Situations have two parts: instructional conditions and the desired outcomes of instruction. Instructional conditions include the nature of what is to be learned (learning outcomes), the nature of learner, the nature of the learning environment, and the nature of instructional development constraints.

According to Reigeluth (1999), the desired instructional outcomes include the level of effectiveness (how well learning goals are attained), the level of efficiency (effectiveness divided by cost and time), and the level of appeal (extent to which students enjoy the instruction).

Our findings from the formative research of the theory enabled us to identify in which conditions and situations the methods of interactions worked.

Methods: Phase 2

In Vivo Formative Research for a Designed Case

Phase 2 of the study involved formative research of the theory. Formative research was done by a review of the literature, expert evaluation and through a field trial. A review of the literature was done to support the optimal participant interaction process around which the theory was developed. Expert evaluation of the theory was done by the instructor of the course used as the designed case study. Finally, a field trial was conducted with the course as it was taught during the summer of 2001.

Formative evaluation of the designed case was conducted as a field trial. The purpose of the formative evaluation was to identify and remove problems with the instructional design theory (Reigeluth & Frick, 1999; Thiagarajan, Semmel, & Semmel, 1974). This took place in the summer of 2001 as the course was being taught. An instrumental case study approach (Stake, 1995) was used. Stake describes the purpose of the case examination as being to provide insight into an issue or to redraw a generalization. Though a case study focuses on a single case, the researchers can construct a hypothesis for generalization by close observation of the case. The case plays a supportive role, and it facilitates the researcher's understanding for more general situations.

Course Context

The instructor, an associate professor in the department, and the associate instructor, a doctoral student, participated in the design and development as well as the implementation of the course. This is the first time the instructor and associate instructor had taught a Web-based course. However, both were very familiar with the content of the course, as the instructor had taught the residential version of the course many times. Nineteen graduate students completed the fourteen-week graduate course during a summer session. Among the nineteen students, eight students were part of a cohort group that had begun a Web-based Master's degree program two semesters earlier. Thirteen students had taken distance courses prior to this one.

The fourteen-week course was organized into eight units plus an orientation unit. Each student was required to participate in two team collaborative activities but could choose whether or not to work in teams for additional projects. The maximum number of team activities a student could participate in was five. The students were given seven assignments total: they were allowed to choose to work on the assignments either individually or in a group.

Data Collection

Data for formative evaluation of the course as part of the formative research on the instructional design theory was collected as follows. The researchers informed course participants that a new instructional design theory concerning interactions was being used for the course. This information was distributed by means of the human subjects consent forms used to obtain participant permission to have their online data be used in the study. Sixteen out of the nineteen students in the course agreed to participate in the study.

Data was collected from multiple sources including two Web-based surveys, interviews and observations via document analysis of the course transcripts of communication, learner reflections and completed assignments. The first Web-based survey was distributed after the first half of the course and the second after the conclusion of the course. Telephone interviews were conducted after the conclusion of the course as well. Eleven students completed the first survey and thirteen completed the second. Eight students participated in telephone interviews after the course ended. Both instructors were interviewed half way through the course and again at the end of the course. In addition to the surveys and interviews, transcripts of the discussion forums, class e-mail, course assignments and feedback, learner reflections and chat transcripts from the Web based course were downloaded from the course.

Data Analysis

Data analysis involved data reduction, data display, and conclusion drawing (Reigeluth & Frick, 1999). First, the researchers worked independently to identify themes based on methods and strategies of the instructional design theory. They then categorized these themes by the instructional method or strategy for which it was intended (English, 1992). After closely reading the data, the two researchers reviewed the categorized data to identify which method or strategy had received the most comments. These comments were then examined by both researchers to identify aspects of the method that were receiving comments by the participants.

The findings from the data were then displayed by placing the categorized data into a matrix, which illustrated relevant situational characteristics. Finally, conclusions were drawn regarding specific recommendations for theory improvement.

Findings

Interaction: Learner to Self

In the beginning of the course, the learners were asked to share their expectations of the course, to post an initial personal theory of learning, to identify criteria for usefulness of learning theories and to post initial reactions to general statement about learning. The goals of these activities were to support learner control and self-regulation as well as to activate prior knowledge. The data revealed that these adult learners have rich resources of prior experiences to their learning. These adult learners valued instruction that is personally relevant to them. It seems to be very important for the instructor to identify the prerequisite skills, knowledge and the needs of individuals before and during the instruction.

As learning activities, learners completed individual as well as team thought activities requiring application of the learning theories to practice. The learners were also asked to participate in whole class discussions on the unit topics. The goals of these activities were for the learners to discover, explore, clarify and negotiate understanding as well as enhancing elaboration and retention. Findings showed that the learners were interested in discussions and assignments that were relevant to their lives and needs.

For reflection on learning, the learners were required to complete self-reflections after each project. They were asked to reflect upon what resources they used to complete the projects and how their understanding changed during the unit activity. At the end of course, learners revised the initial personal theory of learning and instruction from the first week and also participated in a final reflective discussion. These activities supported learner control and self-regulation as well as providing closure. They provided opportunities to create a synthesis framework in which to place the theories and the self-reflections were helpful in fostering metacognitive skill development

Interaction: Learner to Learner

The learners participated in many activities throughout the course building teams and increasing social participation and engagement with learning process. For orientation, an informal icebreaker activity provided a chance for learners to get to know each other. Everyone in class including the instructors was required to post eight nouns that best described themselves. The three most commonly mentioned words in this activity were 1) teacher/educator, 2) learner/student and 3) parent/grandparent. The high frequency of these words revealed the important characteristics of this group of adult learners: many of them were involved in authentic situations of learning and instruction in their everyday lives. The class was also asked to post their personal profiles and digital photographs. This helped building a sense of community.

One of the main activities for fostering learner to learner interaction was collaborative team tasks for the unit assignments. By providing choice in the scheduling of collaborative activities as well as the number of group activities to participate in, the course supported learner control and self-regulation. Because these adult learners had extremely busy schedules, the learners felt that two weeks should be the minimum time frame for collaboration. Having project deadlines on Mondays proved to be helpful for these learners since it provided the weekends for them to complete the tasks. For teamwork, the learners were required to provide feedback on the contribution of team members after the completion of projects. It served the purpose of providing feedback and closure as well as building the sense of a team. For the tools the team used, they used different tools for different purposes. Most used initial chats for the decision making process and found them very useful. Twelve out of 13 students indicated in the second survey that they were satisfied with the amount of student-student interaction in the course. Only eight out of 13 indicated they were satisfied with the amount of student-instructor interaction. Nine out of 13 chose to work in groups again for the second half of the course. Of the four who did not choose to work in groups, two participated in interviews. They indicated that their reason for not working in groups was primarily due to busy work schedules and that they wished they could have participated more in group work.

The learners were also asked to facilitate the whole class discussion by choosing to be either the "facilitator" or the "wrapper" for the unit discussion. This activity increased the engagement with the learning process as well as supporting learner control. Instead of having instructors responding every posting to the discussion, the peer facilitation generated a more student-centered atmosphere. The facilitator role presented a new perspective each week and some of the facilitators took on additional roles in the discussion, such as the devil's advocate, to purposively challenge the peers' statements.

Peer to peer responses were also encouraged throughout the course. The learners were asked to comment regularly on others' postings. Many learners felt the heterogeneity of experiences in the class, the great stories and advice from others' experience was tremendously helpful. They said the multiple perspectives resulted in deeper learning.

Interaction: Learner to Instructor

The primary goals of learner to instructor interaction were to build communication, support learner control and self-regulation, and to provide feedback. They also appreciated instructors periodically checking in on teams' progress and whole class discussion. At times when the topics of whole class discussions would drift away from the theory being discussed, the instructors' guidance and redirection proved to be helpful. Learners also appreciated instructors' participation for the sense of "presence". The learners mentioned that they benefited from instructor feedback that focused both on strengths and areas of improvement. In Web-based environments, where tone is not apparent in writing, increased care is necessary when instructors formulate criticisms.

Interaction: Learner to Resources

Learner to resources interactions were used to present new information, increase engagement with the learning process as well as to support learner control. Because learners access new information at their own pace, they rely heavily on the course Website and resources for all information. In an online environment, it proved to be efficient to provide additional Web-based resources to supplement the text. One of the most important findings was that learners felt that having models or examples of expected work were extremely helpful and they wanted to see more of those. They pointed out that they really liked having examples of good whole-class discussion postings provided at the start of the course. They wanted to have more guidelines for collaborative assignments, more specific grading rubrics and more advice for successful online collaboration. The findings showed that the instructors should be careful not to make many assumptions regarding "Web-course literacy" on the part of the distance students. More time and effort were required than in residential courses, especially for the first time distance learners.

Conclusion

This study presents the guidelines for when and how the four types of interaction should be used to achieve the various learning outcomes. By providing a deeper understanding of the adult learners in a distance course, this research indicates that the all four types of interaction are important methods of instruction in a Web-based learning environment. The findings showed that the adult learners appreciated the variety of assignments and a sense of learner control provided by a balance between flexibility and structure of the course. Providing instruction relevant to the prior experiences and knowledge of these adult learners also played a great role in fostering interactions. Given the appropriate guidance and support, the learners preferred to work on teams. When the experience was positive, it established a sense of community and enabled a deeper level of situated cognition.

For further research, it would be useful to explore the dynamics of collaborative works in Web-based learning environments: the content and discourse analysis of a successful team's experience as well as criteria for good participation and facilitation in class discussions. Greater insight would be obtained by more detailed exploration of the learning outcomes and methods of evaluation specific to adult learners in Web-based learning environments.

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Exploring Innovations in Personalised Teacher Education

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Abstract

This study adopts innovate self-study research methods (Bullough& Pinnegar, 2001) to explore the effectiveness of teachers' use of self-referenced activities designed for the development of personal teaching portfolios. Two short video presentations, along with participant and instructor workshop guides provided necessary instructions and materials. Personalized classroom design and photo activities were completed within a teacher education workshop aimed at developing personal portfolios. Data collection included written/oral activities and videotaped group discussions. Four criterion selected teachers engaged in activities that required the re-design of classroom activities and the use of personal photos. Results indicated that all participants were able to successfully redesign conventional classroom activities as constructivist classroom activities. Photo activities were found to be motivating and relevant to all participants. Recommendations offer insights into future constructivist learning research, the potential benefits of self-referenced knowledge, and the use of self-study research methods.

Educational reform programmes being carried out throughout North America are aimed at offering instruction that accommodates all learners and highlights lifelong learning. There is widespread rejection of the teacher represented as one who delivers knowledge to passive recipients. Instead, learning is viewed as a self-regulatory process involving individual meaning construction and processes of social activity, discourse, and debate, (Twoney and Fosnot, 1996). Current reforms derive theoretical grounding from constructivist learning theory (Lueddeke, 1999). Based on constructivist theory, advocates of educational reforms recommend the use of educational portfolios as an alternative means of learner evaluation for lifelong learning.

Educational portfolios are recognised as a multi-media educational tool for accommodating all learners (Martin, 2000). Educational portfolios are commonly viewed as purposeful collections of work selected by learners to demonstrate learning progress and achievements over some period of time. Portfolios consist of on-going work efforts, students' reflections, self-evaluations, and rationale for work selected that make it up (Cushman, 1999; Daiker, 1992). To this end educational portfolios have been identified as a useful evaluation tool capable of informing on long-term learning growth and formative evaluations. For instance, Durst, et al. (1994) consider portfolio evaluation as a "fluid form of assessment that requires negotiation not a calibrated form of assessment that moves away from absolute judgements about writing into more shaded, nuance understandings of difference" (p. 287). This view of assessment captures what Guba and Lincoln (1989) refer to as "fourth generation evaluation", evaluation which explicitly acknowledges the socio-political, unpredictable, and constructivist nature of evaluation as a teaching and learning process.

Two characteristics of educational portfolios highlight their widespread appeal to the educational reform. First, educational portfolios can cater to a diversity of learner styles by allowing students the opportunity to document learning in the media they are most comfortable (Barrett, 1994). Second, portfolios, specifically, electronic portfolios allow for learners to explore multiple media (i.e., text, graphics, animation, images, audio clips, video clips, etc.). This has importance for educators as well as instructional designers because of the educational reform's commitment to all learners and the educational tools that have been recommended for fulfilling these commitments.

The introduction of constructivist informed educational portfolios marks a departure from conventional educational methodology. Informed by constructivist theory, this study is framed under the assumption that teachers can not model good educational practice when they have never had the opportunity to experience and relate it to themselves. The rationalale for this study is structured around issues in multiple media, advances in image and art-based inquiry, and the signification of the concept of self-referencing in advancing teacher education.

Literature Review

What impact has media research had in education?

Theoretical grounding for multiple media (multi-media) and multiple intelligences comes from various sources. Symbol Systems theory posited by Salomon (1974) presented arguments based on media research to explain how different symbolic forms of representation (e.g., pictorial, verbal, numeric, graphic, etc.) require that individuals use different mental processes. Salomon (1997) adds, "Being part and parcel of the information itself, media's symbolic forms of representation influence the meanings one arrives at, the mental capacities that are called for, and the ways one comes to view the world". In other words, each medium conveys content via inherent symbol systems which, in turn, affects the meaning derived.

Research on multiple media in education covers a wide range on topics with relatively focused objectives according to Salomon (1977). These objectives include: (a) to test instructional effectiveness of a medium or technology, (b) to investigate psychological effects of media and technology on individuals, and (c) to enhance the practice of education by providing and evaluating media and materials. The greatest challenge in multiple media research has been to convert media's potential to fulfill educational purposes. Criticisms in the field come from opposition to media-based instructional aims, such as instruction in visual literacy and media awareness (Snow, 1970: Cassidy and Knowlton, 1985). One potential problem of media research is the lack of solid evidence of how symbolic forms can be used to enhance diverse educational practices. This is a problem of association in my view.

In a similar vein, Gardner' s Multiple Intelligence theory (1983) asserts that different intelligences represent not only different content domains but also learning modalities. Under this framework, multiplicity in cognitive processes gives rise to multiple forms of representation that influence individuals' understanding of phenomena. Recognition of multiple forms of representation has been connected to diversity of personal learning styles (Gardner, 1993). There is, however, a challenge when dealing with intelligences that are difficult to represent (i.e., affect) and are considered only placeholders in contemporary educational psychology research. One potential problem is a lack of research that succeeds in drawing out mental processes theorised about but never observed. This is essentially a problem of representation in my view.

Problems of association and representation call into question whether or not different symbolic forms that call on different cognitive capacities affect the way individuals represent the world to themselves in some meaningful and lasting way that could provide leverage for advancing education.

Can image and art-based inquiry make a difference?

Image and art-based techniques are becoming increasingly popular in the field of education. Image and art-based techniques initially used for therapy are becoming part of a recent trend in educational research (Davis & Butler-Kisber,1999; Prosser, 1999). Art-based research has been used to enable individuals to externalize conflicts and remove mental blocks (Davis & Butler-Kisber's,1999). The authors treat the collage as a functioning form of analytic memo to complement other forms of representation by providing a means to self-critique. Cartoons and other types of visual images have been used to reconstruct and reify perceptions of public narratives through analysis and interpretation (Warburton, 1998). Warburton's own semiotic approach to cartoons treats cartoons as public pictures or cultural artefacts, defining meaning according to how the image is produced and the intended use of the image. This type of work has typically been used to enrichen educational practices but could contribute as well by extending the *breadth* of representational forms beyond what is presently studied in educational research.

In another domain, image-based techniques have offer a unique capacity to inform on processes difficult to access by other means. Prosser and Schwartz (1998) discuss the use of photographs within qualitative research to probe for personal knowledge:

> Through our use of photographs we can discover and demonstrate relationships that may be subtle or easily overlooked. We can communicate the feeling or suggest the emotion imparted by activities, environments, and interactions. And we can provide a degree of tangible detail, a sense of being there and a way of knowing that may not readily translate into other symbolic modes of communication. (p. 116).

Image-based psychoanalytic techniques and other forms of memory work employed in therapeutic and transformative practices also extend the *depth* of representational forms beyond what is presently studied in educational research by providing researchers and educators with useful insights on how to overcome problems of representation by uncovering mental processes previously hidden.

What is self-referenced knowledge and its role in learning and research?

Entire branches in philosophy are directed to issues of knowledge representation, reference, and meaning formation. Without digressing into lengthy discussion, representing objects and states of affair is considered a part of the mind's general capacity to relate an individual to the world. Consequently, the knowledge representations individuals are capable, in what context they occur, and how they occur are instrumental in informing on learning. Equally important is where representations point, there referentiality.

This study puts forth the notion that what distinguishes image and arts based research in the domain of education lies largely in their self-referencing quality. Self-referencing is employed uniquely here to describe the relation of the representation perceived by the individual who conveys it to him/herself. Unlike many learning contexts which involve the construction of knowledge, acquiring self-referenced knowledge also implicates the learner's self-concept, resulting in greater possibilities for conceptual associations to be made and higher-order thinking to be achieved. Self-referenced knowledge involves being able to recognise oneself in what one does. This is exemplified by answering questions like: Does this experience relate to who I am and how is this experience important to me personally?

How does self-referenced knowledge make a difference?

Failed attempts to integrate constructivist oriented educational reforms and educational portfolios is one area where the absence of self-referenced knowledge is having an influence. Where teachers have little or no personal experience with educational portfolios or their assessment, portfolio training materials have been implemented for teachers that focus on the development of professional knowledge (Ruskin-Mayher, 1999; Silva, 2000). Results have indicated, however, that this fails to get at personal knowledge and skills development (Au, 2001b; Frederick, McMahon, & Shaw, 2000, Silva, 2000). Wadlington & Partidge (2000) comment "Before teacher educators can ask preservice teachers to use journals, self-assessment, peer conferences, portfolios, observations, and so forth, they must first model these techniques themselves." Similarly, Cushman (2000) speculates, " What if educators presented portfolio evidence of their own learning and growth? What if they tried to show in concrete ways how that growth affects student learning? Doing so, many are coming to believe, might shed new light on some of the most intractable questions in the current debate about school change."

Consequently, there are a number of questions that have not been fully explored. First, do teachers perceive a need for personal development to be able to successfully adopt this new form of classroom instruction? Second, can the participation of self-referenced practices advance teachers' understanding and comfortability with current educational reform policies?

What is missing from teacher education?

The study posits that teacher education should not only cultivate professional expertise, but also self-referential expertise. Understanding ourselves as educators is of fundemental importance. Being able to explain our reasons for doing something or choosing this way over another brings additional meaning to what we are doing (Connelly & Clandinin, 1999, p. 11). Portfolio training materials do exist for teachers that focus on the development of professional knowledge (Ruskin-Mayher, 1999). Professional knowledge is comprised largely of step by step instructional procedures for teaching reflective processes, self-assessment, and peer reviewing within a classroom setting, along with sample activities, and evaluation rubrics. This does articulate the importance of personal experience and skills development considered essential to effective instruction (Silva, 2000). How can teachers engage in reflective processes and self-evaluate when they have never had the opportunity to experience it themselves in their own learning? How can teachers model good educational practices when they have not personally experienced what they are attempting to model?

Rationale

The rationale for conducting the following study stems from longstanding work in image and art-based clinical research exploring psychological processes not accessible by other research methods through self-exploratory techniques (Weiser, 1993). Weiser (1993) demonstrates the success of photo-therapy techniques in helping individuals to represent personal knowledge not directly assessable. Such therapeutic techniques offer innovative avenues of exploration through their power to use images to invoke personal knowledge. In addition, art and image-based approaches to learning offer the potential to leverage educational reform efforts by contributing research knowledge of multiple representational forms. To this end, the self-referenced knowledge approach has been developed to contribute to teacher education in a way consistent with advocated reform ideas. This innovation was tested by evaluating its effectiveness in improving teachers' attitudes and abilities to apply constructivist concepts and portfolio processes to professional practices. The self-referenced dimension of learning was highlighted throughout the workshop instruction by appealing to the power of personal meaning formation, and self-reflection through personal photo use and its role in constructivist informed learning practices.

The main objective was to identify challenges and determine whether self-referenced knowledge can be an effective teacher education intervention for advancing expertise and improving attitudes of constructivist informed educational portfolios. To this end photo-therapy techniques were adapted to a teacher education workshop aimed at developing personal portfolios by: 1) appealing to the power of personal experience, and 2) exploring the use of self-referenced knowledge to advance teacher expertise.

Method

The study conducted was a qualitative *case study* of a teacher workshop. Merriam(1998) defined case study as," an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (p. 21). The study focused on the experience of learning from the integration of participants' perspectives and is based upon a constructivist orientation to qualitative research. The guiding premise for conducting the case study was that understanding arises most meaningfully through open-ended activities and ongoing exchange between all participants. Qualitative methods used to gather information follow a constructivist paradigm aimed at reflecting the multiple perspectives constructed by those involved in the inquiry, including the researcher (Lincoln & Guba, 1985). This method was chosen for its capacity to provide in depth evaluations for generating holistic lifelike descriptions, illuminating meaning, and communicating tacit knowledge (Guba and Lincoln,1981, p. 375). This type of description is especially useful when dealing with contextually sensitive image-based data:

> Photographs get meaning, like all other cultural objects, from their context. Even paintings or sculptures, which seem to exist in isolation, hanging on the wall of a museum, get their meaning from a context made of what has been written about them, either in the label hanging beside them or elsewhere, other visual objects, physically present or just present in viewers' awareness, and in discussions going on around them and around the subject the works are about. (Becker, 1998, p. 88).

The Role of the Researcher

Prosser and Schwartz (1998) indicate, "Before qualitative researchers begin to mine a site for the data it holds, we need to consider how we present ourselves to our subjects" (p. 119). The researcher's in data collection is a participant-researcher perspective, where workshop activities include researcher participation and data collection includes the researcher's perspective as well as those of the other participants. This insider approach creates an open and sharing environment for discussion. The methods of data collection chosen are designed to empower participants and foster a sense of personal ownership over data.

Data Collection

Participants in this study were educators who have taught in Quebec. Four participants, not including the participant-researcher, were used in this study (N=4). The number of participants falls into the acceptable range for field testing of instructional workshops. The study was carried out at Concordia University in the spring of 2001. Data was collected directly from the participant researcher and other participants through the following: Teacher Portfolio Questionnaires (TPQ), group discussions and oral activities transcribed from videotape, and group writing activities.

Validity and reliability of instruments

In qualitative case studies, validity and reliability issues are dependant on the researchers ability to convey the trustworthiness of research findings and the researcher's success at providing a convincing description of the action or event taking place (Merriam, 1998, p. 198). Firestone (1987) points out, "The qualitative study provides the reader with a depiction in enough detail to show that the author's conclusion 'makes sense" (p.19). Internal validity refers how much the research findings match reality but reality is holistic multidimensional, ever-changing, researcher influenced under a qualitative research framework (Merriam, 1998, p. 202). According to Lincoln and Guba (1985) human beings are the primary instrument of data collection and measuring internal validity depends how closely reality can be approximated by close observation and inquiry.

Following Merriam (1998), multiple steps were taken to ensure a high degree of internal validity in the present study: triangulation, participatory research method, inter-rater reliability. First, multiple sources of data collection were used to provide an adequate diversity of finances to triangulate. Second, the reseearcher participated in the study and all activities. Third, inter-rater reliability was employed by having a selections of activity responses scored by an outside scorer.

Issues of reliability were also important considerations in this study. The notion of reliability is viewed as the consistency of the results from the data collected (Lincoln and Guba, 1985, p. 288). A high degree of reliability was secured through explanations of data collection and interpretative steps (Lincoln and Guba, 1981). Finally, efforts were made to provide thick descriptions and participant commonalties (LeCompte & Preissle, 1993) in order to allow for the possibility of generalisations to be made.

Data Analysis

Data analysis was based on assumptions stemming from a constructivist framework which highlights: the importance of the individual experience, the wide range of perspectives possible, and the public sharing of meaning. Following Maxwell & Miller (1996) two types of qualitative data analysis were employed: paridigmatic and syntagmatic. Paridgmiatic relations are determined based on their similarity or difference in meaning, whereas syntagmatic relations are concerned with the relationship of entities within the context. In the present study, questionnaire and activity results are paridigmatically coded with a themantic classificatons derived from the presentation material. Contextualizing strategies in the form of narrative summaries and direct quatations were applied to discussion and oral activity data. To this end, I examined perceived abilities and attitudes towards portfolios, instructor profile, group results on constructivist design activity, group results on photo portfolio activity, and discussion results. In addition, I examined my own beliefs and participation in the study conducted.

Findings and Interpretations

Teacher Portfolio Questionnaire (TPQ)

All participants received the Teacher Portfolio Questionnaire (TPQ) prior to the workshop field test to complete (Note: all names are fictitious to preserve the identities of those involved). The questionnaire was designed to assess level of prior experience with and attitudes towards portfolio use. Both paridigmatical and non-paridigmatic types of data The results of each participant are summarised to provide participant profiles:

> *Len* is a doctoral student in an educational technology program. He has two years of teacher assistant experience in Quebec and in currently involved in project collaborations within the educational reform. He has two years experience using art and writing portfolios and enjoys their capacity for demonstrating learning growth. What he enjoys least is how poorly they are been used for evaluation in educational settings.
>
> *Bob* has taught for 35 years. He has used digital and photographic portfolios. He perceives his own abilities with using portfolios in teaching as ranging from excellent to fair. What he likes most about using portfolios in learning activities is the variety. What he likes least is that they are difficult to evaluate from a criterion standpoint.
>
> *Vicki* has taught for 2 years. She has used math, art, and language arts, portfolios. She perceives her own abilities with using portfolios in teaching as ranging from very good to good. What she likes most about using portfolios in learning activities is that learners can see their own work. What she likes least is that they are difficult to evaluate.
>
> *Candice* has taught for 27 years. She has used math, art, and language arts, portfolios. She perceives her own abilities with using portfolios in teaching as ranging from very good to good. What she likes most about using portfolios in learning activities is that learners can see their own work. What she likes least is that they are difficult to evaluate.
>
> *Betty* has taught for 15 years. She has used writing and art portfolios. She perceives her own abilities with using portfolios in teaching as ranging excellent to very good. What she likes most about using portfolios in learning activities is that they are flexible. What she likes least is that they are time consuming.

All participants rated their ability with using portfolios as excellent to fair. Experience with portfolios ranged from participant to participant from the types used and the number of years using them. The likes and dislikes for using portfolios in teaching varied from participant to participant, however, three of the four participants shared a dislike for the difficulty of assessing portfolios.

Instructor profile analysis

Discussion data and reflective field notes from the instructor were analyzed for indicators of belief and attitude. Categories extracted include: personal belief, optimist, and motivator.

Personal Belief Len, the instructor and designer or the workshop field test had his own views on life and learning. He believed that no amount of knowledge would compensate for the need to understand how we are as humans whom possess a unique relation to the world, to each other, and to themselves. He was sensitive to issues of personal meaning, and letting people determine their own educational direction:

> Going towards some method of learning and evaluation that everyone can get something out of--something that your allowed ownership of for one reason or another that you can develop into something. Moving towards portfolios could be a really good way to accomplish that if it is done correctly (discussion extract from Len).

Optimist During the workshop instruction there was some apprehension among participants as to what professional knowledge could be gained from engaging in personalised learning activities. Participants were not at all sure how teachers could both satisfy personal likes while making sure that learners acquired necessary formal knowledge. Len's approach was one of optimism and openness:

> There is some sort of formal knowledge that is important to acquire, but it does mean that you have to do it the same way. It would be interesting if everyone's activity that they redesigned suited them best and their style and the things that they like. So a lot of the objectives or redefined competencies end up being accomplished, but in a way that is more enjoyable for the teacher and hopefully more enjoyable for the student (discussion extract from Len).

Motivator Len found himself in the role of motivator and animator in the workshop. Given the open-endedness of activities, participants were unsure of the appropriateness of their responses. This was revealed through comments made by participants. Len facilitated the discussion by having participants share their work. He attempted to provide positive feedback by summarising participants work and highlighting positive points:

> That's kind of a wonderful constructivist activity. They're engaged in a social activity. They are going beyond the information given discovering things maybe the instructor didn't even intend. They are critically thinking by making a evaluation in their groups. It requires them to work together individually and to communicate effectively in a hospitable and democratic fashion (discussion extract from Len)

Together, aspects of the instructor's role were found to be extremely relevant and did have an effect on the participants by being optimistic and providing motivation. This connects with attitudinal and ability factors identified in the group discussion (i.e., motivation, perceived integration challenges, and transfer of learning). One possibility is that the instructor played a vital role in helping participants overcome resistance, rationalise challenges, and re-create their learning (learning transfer).

Constructivist Design Activity

All four participants participated in an activity to redesign conventional classroom activities as constructivist classroom. Findings are summarised in the table below:

Table 1: Constructivist Design Activity

Conventional Activity	Constructivist Activity
Conducted a spelling bee with two teams	Redesign of Spelling Bee. Instead of asking them to form competitive groups, I would probably have them: -write their own pieces and then in dyads have them try to correct their spelling. -peer proof reading using dictionaries and asking others -this way the spelling becomes more personally meaningful. (Candice)
Lecture	Redesign of Lecture: -Hand out typed version of lecture in 4 pieces. -request each student make a mind map of the words (ideas) and turn in the piece they got. -duplicate so that everyone has a complete set. (Bob)
Teaching math classification on blackboard.	Redesign Teaching math classification on blackboard. -Introduction with real objects that are familiar to kids (a shoebox ,marbles, wood blocks etc.). Name the objects and divide into groups; group A 'squares' , group B 'circles' and group C 'rectangles. -Groups of kids go on a square, rectangle, or circle hunt and bring objects to a specified spot for examination and decide in their smaller groups whether what they found is accurately classified. -Then the objects are examined by the larger group. (Betty)
Puzzle Pieces 5-yr olds put together a simple puzzle.	Redesign of Puzzle Provide children with blocks (3-D) and have them create their own structures. (Vicki)
Teaching Fractions I gave examples of math from text book and then a demonstration (divide a plate into quarters)	Redesigning Teaching Fractions -Bring fruits in and have class break into groups -Groups cut them up in pieces and present their hypotheses about the dividing exercise and come up with a new way to do it (the fraction exercise.). (Len)

Written activities were rated for the presence of constructivist learning competencies delivered in the presentation. The instructional aims at the beginning of the workshop were to demonstrate three constructivist learning competencies. A scoring template used by the researcher was constructed directly from the workshop material to score the presence or absence of constructivist competencies. Findings indicated that all participants incorporated three constructivist learning competencies into their written responses.

Table 2: Percentage of Participant Competencies Achieved

Participant	Percentage of Competencies
Bob	100 %
Vicki	100 %
Candice	100 %
Betty	100 %

Although all participants were able to fulfil the instructional aims, the activities themselves were not perceived as easy. None of participants found the workshop overly easy. Comments indicated participants found the activities relatively challenging: " This is hard to do (Betty)," "I am not a conventional teacher. I am finding this one hard (Candice)," and "This is tough (Vicki)." This can be interpreted as an indication participant success was not due to the simplicity of the activities chosen. Another possible interpretation is that participants had high levels of personal interest in the material and were highly motivated to learn.

Photo Portfolio Activity

Completing *the photo activity* required the demonstration of the following portfolio competencies: selection, reflection, and peer sharing. Participant responses are presented as direct quotes to preserve the completeness of description and to avoid possible researcher biases that arise from de-contextualizing responses. A scoring template used by the researcher was constructed directly from the workshop material to score the presence or absence of portfolio development stages. Findings indicated that all four participants were able to meet the workshop competency objectives to perform three competencies of personal portfolio development and incorporate three stages of portfolio development into personal learning. The nature of the responses was unique from case to case.

Candice.

Candice had chosen a photo of herself sitting on a patio on a summer afternoon. The patio was filled with guests and the guests were dressed for a formal occasion. In the photo a man was turned to her as she looked in his direction:

Candice: "One of the things I said about this picture in my own comment on what it revealed to me as a learner seemed to show my intense nature There is a look in my eyes and the way that I am sort of judging and gauging things and reactions. Now can I read yours" (Selection, Reflection)

Candice: " One of the things Betty said was it reveals awareness of ability to communicate with facial expressions so she saw something in my face as well, which is an interesting comment. So now if I wanted to write more about that picture I would use that comment which I might do. . ." (Sharing)

Bob: " You also have quite a bit of body language in there" (Sharing)

Candice: " Yes I do and I suppose If you were gonna write about me you would probably mention that." " In the upper box Betty said that this person looks flabbergasted. What are you talking about is that I am not interested and it is true. If you look at this my body language it is saying I don't want to talk to you. This happens to be at a family wedding and this particular individual I was being as polite as I can but my body language is . ." (Reflection)

___Candice's own interpretation is expanded when Bob picks up on the way she had her legs crossed in the photo. This was one aspect that Candice did not notice and something that, one stated, she was able to build on and tie into another participant's written comments on the same photo. This could be interpreted as a good example of how individual reflection can be expanded upon by others' perspectives.

Overall, photo portfolio activity findings were positive. Interpretations of photo portfolio findings revealed the following:

1) Individual reflection can be expanded upon by others' perspectives.
2) Individual reflections can be complemented by confirmatory comments from others.
3) Photo activities are not exercises that are detached from learners, but rather, are authentic and related individuals lives.
4) Personal photo activities can become socially motivating and relevant to others.
5) Photo activities can acquire a meaning beyond what is contained in the photo itself and connect with events and people independent of the photo.

Group Discussion Findings

Discussion results were transcribed and coded thematically. Categories extracted revealed the following trends in participants' responses: 1) motivation 2) perceived implementation challenges, and 3) transfer of learning.

Motivation Findings indicated a lack of motivation towards the constructivist informed educational policies currently being implemented. This was revealed through discussion:

> Then you can have constructivist practices or constructivist activities, but you're never gonna have real constructivism witch is why in my opinion it makes it very difficult for the MEQ to say we want everything to be constructivist (discussion extract from Candice).
>
> It seems to me that probable this reform is not legitimate, that for a reform to be legitimate the stakeholders have to discuss it and come to some understanding about it. Then you can bring it about. If you just have top down imposition of something. If people have low power they will comply with it superficially. If they have high power they will go on strike or something like that. Unfortunately the teachers are mostly in a low power situation. However the parents are not. The parents are in a high power situation so they can effect it (discussion extract from Bob).

Implementation challenge Findings also indicated a perceived implementation challenge for widespread constructivist informed educational policies:

> I just have a question about the constructivist Ideas for education. I think the biggest challenge for constructivist philosophy is the parents. They're going to come into the classroom, and they want to know what is going on here. You have kids running around the place doing whatever they want. I am taking my kid out of this school and putting them in another school. I can see the parents really reacting that way and how do you handle that. I think we have to put the parents in there somehow (discussion extract from Betty).

Transfer of Learning Discussion results indicated a transfer of learning from the constructivist activity to the portfolio activity. There were instances where the participants integrated attributes into the personal photo activity that drew from social and critical constructivist characteristics experienced in the first activity: This was revealed through discussion:

> The other factor is the photographer. The decision a photographer makes about how to frame You, where to put you in a picture." " I am just trying to say that depending on the photos you choose, some photos do not necessarily have that capture of you. So if you went to a professional photographer to get a nice head shot for a movie you are not going to look like you. So if I give a picture on how someone can dress up a photo of you the feed back is really about the photo too. You choose it but there is something about the photo that you have to factor in (extract from Betty).

Also, the constructivist characteristic of communication and morality became a part of the photo activity as exemplified by Bob's concern " This is an intrusion, I mean when I write something like that to some extent that is an intrusion into Betty's world so we have to have a situation where there is a reasonable trust or in this case, the okay when someone can intrude in on my world."

The categories that emerged from the analysis can be best interpreted by recognising their attitudinal and ability components. Accordingly, participant motivational factors and perceived implementation challenges can be interpreted as attitudinal indicators. Scepticism concerning the MEQ's capacity to succeed and questioning the legitimacy of the educational reform can be interpreted as attitudinal indicators of *resistance*. Similarly, a perceived lack of parental involvement and teacher ownership can be interpreted as attitudinal indicators of *rationalisation*. Participant ability factors can be interpreted as ability indicators. Being able to integrate aspects of the constructivist activity into the personal photo activity can be interpreted as an ability indictors of *recreation*.

Together, the attitude and ability indicators reveal a different set of threes R's than is traditionally associated with education: resistance, rationalisation, and re-creation. The clearest interpretation from a constructivist standpoint would be to treat resistance, rationalisation, and re-creation as developmental steps in the learning process. This is consistent with contemporary models of professional development where new learning is first met with resistance, followed by a number of additional steps required before accommodation can take place.

Educational Implications

Contribution to educational theory

In the present context, individual participants demonstrated resistance, rationalisation, and re-creation processes with a community of learners. This draws attention to the importance of providing teachers, as advanced learners and professionals, the opportunity to discuss personal challenges and raise issues so that some sort of rationalisation can be achieved. This furthers constructivist theory in education by identifying the impact of personal and social factors within learning contexts.

Contribution to educational research

Having the opportunity to discuss personal challenges and raise issues with others could have considerably impact on individuals' capacity to integrate new learning (re-create). This provides empirical evidence that self-referential knowledge does impact on professional development interventions carried out within groups. The fact that personal photo activities were found to be motivating and relevant offers insights into constructivist learning research, and the use of self-study research methods, which have attracted much recent attention in the educational literature (Bullough & Pinnegar, 2001). Future research will consider how patterns of resistance, rationalisation and re-creation occur in different professional development contexts.

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Digital Television: The Future of Education?

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Introduction

Digital technology has turned a new page for TV Broadcasting. The convergence of television and computer brought about powerful effect to TV viewing experiences. Not only in the TV evolution, but also in the distance education, digital broadcasting combined with the Internet is conceived as a new driving force that will revolutionarily change the mode of learning in the very near future.

ITV program and Web-based instruction have appeared to be the most common ways of distance course delivering in the past one decade. Each of them has different attributes that meet different learners' need. However, many educators believe that the interaction and two-way communications that are required for all learning are not as effective in these two modes as in the face-to-face instructional format due to the limited potential of the existing technologies. Poor or time-buffered images, low-speed transmissions and high costs are part of the obstacles that were experienced by educators in embedding interactivity in the distance education program.

Many educators perceive that Digital Television and technology would possibly improve the current state of interactivity in the distance education due to its advanced features. High resolutions and digital transmission would make the communication much more clear and easier. One possible use of Digital television in education, as Carvin (1998) described, would be enhanced TV, which supplemented by multimedia content to provide interactivity for learning needs. Various contents such as web pages, quick time movies and text scripts can be composed into the framework of course design. However, DTV technology is still in an early developing stage. There is insufficient information and few studies had been done for educators for pedagogical uses. It would be necessary to investigate those potential effects DTV could bring to distance education, and what learning aspects DTV would contribute. This review will explore DTV's attributes, discuss some possible applications for interactivity and the underlying theoretical and research bases.

Discussion

The basic job of distance educators is changing adult behavior (Verduin & Clark, 1991). According to the perceptual theory of psychology (Bills, 1959; Combs, 1959), how individuals view people and the objects and events in their environment will greatly influence how they behave. Verduin and Clark (1991) further explained the theory that "Behavior is a function of perceptions. Perceptions can be consciously or unconsciously constructed through several interactions with the environment." "It is through this construction that they tend to display behavior." Environment is critical to distance learners for behavioral changes, so that learning may occur. In distance education, environment relies heavily on the technologies. Through technologies, distance learners are able to interact with environment, communicate with the instructor and other students. In his "guided didactic conversation" (1989) theory, Holmberg proposed seven background assumptions for Interaction and Communication. He believed that the core teaching consists of interaction between the teaching and learning parties. Emotional involvement in the study and feelings of personal relation between the teaching and learning parties is likely to contribute to learning pleasure. Also, a friendly, personal tone and easy access to subject matter contribute to learning pleasure. Learning pleasure supports students motivation, and strong motivation facilitates learning.

The purpose for learning is to be proficient in a field or fields. Knox (1980) in his theories on adult education suggests that proficiency is a key construct and is actually the capability to perform effectively in a given situation. This capability usually depends on some combination of knowledge (the cognitive domain), physical skills (the psychomotor domain), and the attitudes (the affective domain) that the adult processes. Therefore, to enhance an adult's proficiencies and capabilities to perform and to facilitate learning, educator must place the three major domains at the center of instructional thinking and planning for adults (Cranton, 1989). Consequently, to build adult learners' proficiency in the distance environment, it is essential that the three major domains achieved by the students through an interactive manner.

However, the limitation of technology constrains the interaction and give-and-take processes of learning. When interaction is made less complete due to loss of aural and/or visual stimuli, expressions that might have communicated meaning are lost (Verduin & Clark, 1991). Besides, difficult access to subject matter discourages learning pleasure and lessens students' motivation. Many efforts have been put on the improvement of technology-based learning environment to produce interactive instruction and learning activities. Digital broadcasting comes along with advanced features that many educators aware that might bring about a leap in distance education. A discussion of these features from the perspective of Knox's (1980) proficiency domains and interactive learning is followed.

Video/Audio effects in learning

Audio accompanied by static print materials has demonstrated to be as effective as face-to-face classroom instruction for step-by-step procedural tasks (Wisher and Priest, 1998) as well as graduate education (Burge and Howard, 1990). Similar to audio with static print materials, audio graphics transmits a visual image accompanied by an instructor's voice, usually through audio conferencing to students at remote sites. The students do not see the instructor, but rather attend to content. Audio graphics should result in the same learning outcomes as audio with print materials (Wisher & Curnow, 1999). Both of these two forms support one of the three types interaction occurring in distance education as described by Moore (1989), the interaction between student and content. The type of interaction is most important. In a study that investigates perceptions and effects of image transmission during Internet-based training, Wisher and Curnow (1999) indicated that there are categories of learning for which there is apparently little need to see the instructor, such as learning declarative knowledge or facts. However, there are some learning tasks that instructor's visual clues are required such as training in first-aid procedure or communication skills such as sign language, depending on visual motion cues during instruction (Wisher and Curnow, 1999). In fact, visual images of lesson materials and instructors are both essential depending on different knowledge learning. Instructional or instructors' image can support and facilitate students' cognitive learning domain, according to Bloom's systematic way of viewing cognitive growth (Bloom and others, 1956), from knowledge comprehension, application, analysis, synthesis to evaluation.

DTV is able to transmit lesson content and instructor's image as well as motions. Except for an ordinary image communication, the image will be presented in an aspect ratio of 16:9, which is different from the conventional 4:3. The screen is formatted more rectangular and much closer to the way people see. Image fills more of the field of vision and has a stronger visual impact. Generally, publics consider that a larger and more rectangular screen is preferred by most of the audiences. Besides, DTV has smaller pixels that are close together, so there are more pixels in a space on a screen (4.25:1 compared to NTSC standard). DTV pixels are square, just like most computer monitors, are able to remove image distortion and present a high-resolution image (Cringely, 2001).

But in what degree do student's perceptions and preferences toward video capability relate to learning? Research findings from instructional television indicated that there is generally no significant relationship. In a study by Greenhill, Rich, and Carpenter (1962) that examined preferences for screen size, students are divided into two groups and assigned to small or large screen. The results show that students prefer larger screen, but their preference was not related to achievement in this course. In one other study of the effect of visual display, Johnson and Stewart II (1999) found that more immersive visual display had no effect on gaining special knowledge. However, the size and ratio of screen might have impacts on students' satisfaction to learning experience. Students' satisfaction will have effect on their affective learning domain. Affective domain where receiving, responding and valuing (Krathwohl, Bloom, and Masia, 1964) foster the formation of attitude toward followed learning behaviors.

Audio effect had been found influential to student's affective learning domain. In Kelsey's (2000) study of the interaction in a course delivered by interactive compressed video technology, the most significant and effective barrier to interactions was the limitations and failure of ICV technology. Echoing and squealing noises, as well as time delays and disconnections, inhibited interaction between guest speakers and students. Speech that was mediated through ICV technology lacked the spontaneity and lucid flow that is expected during face-to-face conversion. Students reported that interacting during the live broadcast was problematic because communication delays gave speech a choppy and unnatural sensation.

DTV technology adopts Dolby Digital/AG-3 audio encoding system to broadcast sound. The sound would be much sharper and crispier. DTV broadcasting uses digital high-speed transmission, more consistent the data will stay over distances. Although both analog and digital signals get weaker with distance, while the sound and picture on an analog TV slowly gets worse, the sound and picture on a digital set will stay perfect until the signal becomes too weak. There is convincing reason to speculate that DTV wil3l have positive effects on students' affective learning domain (Cringely, 2001).

DTV and Interactivity

Vrasidas and Marina (1999) in their study of factors influencing interaction in an online course indicated that there are factors directly influence interaction, including learner control, transactional distance, feedback, and social presence. Among the three factors, learner control is central to the notion of interaction. Garrison and Baynton (1987) described that the concept of control consists of three components: independence, power, and support. The proper learner control should be a balance among these three components. To expand more precisely, independence is the degree to which the learner is free to make choices. Power is the abilities and competencies of the learner to engage in a learning experience. Support is the resources available that will enable the learner to successfully participate in the distance education course. Improvement in television delivery methods created new options for distance learners to communicate (Machtimes and Asher, 1996) also might increase the capability of learner control.

Currently, HDTV is the best-known term for digital broadcast TV. When a show is digitally broadcasting on the television, the audience can interact with the content of the show online and get immediate feedback. Yet, the potential for DTV can be greater.

Datacasting

According to the Guidebook to DTV developed by Harris Corporation, DTV will allow broadcasters to deliver ancillary digital data in variety, such as web site materials, multimedia content, program, and non-program related information. DTV is also capable of delivering data hundreds times faster than traditional modem. An enormous amount of content could be sent through airwaves without requiring the user to subscribe to an online service or to have a wired computer connected to a high-speed Internet connection. These are things that traditional broadcasting can never accomplish.

Digital transmission is operated in a way that more data can be transmit, and more types of data could be carried through the same amount of bandwidth because more information could be carried in a digital signal by using MPEG-2 encoder to compress data. DTV broadcasting technology has one-to-many, real-time, high-speed data-delivery channels. Any program created by educators for delivery over digital media CD-ROM, IP web stream can be transmitted to any individual receiver or all receivers in the coverage area. When TV stations are transmitting less demanding signals, greater capacity for datacasting becomes available (Cringely, 2001).

Multi-casting ability

Instead of broadcasting in a high definition mode, Digital TV can be programmed to broadcast in standard definition mode while it multicasts four choices at the same time and the same channel. Some broadcasters, including many PBS stations, have already planned to multi-cast four choices of programs during the day and then switch to high-definition for prime-time. This option offers more choices, make viewing experiences more interactive (Cringely, 2001).

Interactivity? Or not?

Corporation for Public Broadcasting (CPB) conducted a study (1999), "Will TV viewers want interactivity?" to evaluate prototypes of digital public television programming. According to CPB, the prototypes were designed to demonstrate potential interactive techniques of DTV, and to get reaction from viewers. There are some interesting initial findings. They are summarized as follows:

Benefits of interactivity

- Control: Viewers feel that interactivity allows them to have more control over what and how much they wan to see and learn about a particular topic.
- Additional information: At the most basic level, people want interactivity to provide more detail information.
- Richer viewing experience: Interactive programs are perceived to be more engaging and providing more pleasurable experience.
- Better Education: Almost all viewers in the study see interactive television has a vision of formal and informal educational use of technology.

Negative impact

- Distraction: It is difficult for most people to concentrate on the separate information streams at one time. It is easy to lose focus.
- Weak underlying program: Viewers expressed the fear that producers will spend too much time on the interactivity material and reduce the quality of the program.
- Difficult interface: Viewers get frustrated when the interaction does not occur the way they would like them to, and that different programs have different types of interface.
- Make television too much work: Viewers have a fear that complicated interactivity will make the television too much like computers that they crash, require updating, and viewers need training to operate the television rather than simply click on the remote.

Unanswered questions

After the study, although participants see great potential for interactive digital television, they also left with many questions that need to be answered. According to the report (CPB, 1999), viewers want to know how and when this technology will happen, what will be available, what equipment they will need to get, and how much the hardware and the service is going to cost. They said that they need to get clear answers to these basic questions before they can make intelligent decisions about what hardware to buy, what service to choose, and when they should start the process.

Practical obstacles

As the results of the prototype study show that there are potential problematic and questionable areas in the technology of digital television. Carvin (1998) also summarized several issues that all future broadcaster and consumers of DTV should consider about this technology.

- Cost: At the beginning of any new type of technology, the cost to acquire it can be grant. DTV is no exception. This may put consumers to a halt when buying a piece of equipment that they know little about. Also, consumers may feel reluctant to give up the old analog television that they already have, and they then need to get a converter for the digital signals to decode the transmission to their household. Even the converter can be expensive, at least for some families that need it most to afford. The price for all DTV equipment may go down someday, but not in the most immediate future.
- Content availability: According to Carvin, not so many producers are actively producing materials for the digital market, but a lot of them are taking the analog TV programming and retool it for digital. Therefore, they are not producing the content specifically for the technology. Also, the program content may not even fit with the new

medium. If the consumers pay to get the old content that they used to see in analog TV, and to find that there is not much available content for the new technology, they may not even want to invest their money on it in the first place.

- Interactivity: Carvin mentioned that though digital TV signal transmission may be advanced, one thing is not changed: DTV is still a one-way stream, similar to the traditional analog TV because DTV spectrum can only be used by licensed broadcasters, not consumers. It means that in order to have interactivity, DTV needs to utilize other ends to have the consumer transmit information back to the broadcasters. So far, Internet seems to be the primary back channel for DTV communication.
- Commercialization: Just like the Internet, when a new technology starts to attract and become accessible to a significant public market, commercialization comes into view. Also, TV networks invest huge amount of money into the transition, and they want to see some pay back from the market. If making a profit is all people think about DTV, they will be unlikely to put educational programming as a priority. Even if Public Television takes up the responsibility to provide educational programming, with possible high cost and moderate return, how long can they last?

Carvin (1998) made no mistake in saying this, " There is a lot of potential in digital television but there are also a lot of excuses for us to not take advantage of it." It makes one think more about how this new technology should be utilize for the better of the society.

Summary

Digital TV is the most recent major advance in television broadcasting in nearly 48 years, with improved audiovisual features, and supposedly it will also improve students' satisfaction level in their learning experience. However, because DTV is relative new and yet to be accessible to majority of the society, little research has been done to see its effects in education. The prototype study conducted by Corporation for Public Broadcasting did yield some exciting findings and implications for DTV program developers as to viewers' feeling of being in control, having richer viewing experience, encountering weaker content, and trouble dealing with complex interface functionality.

David Carvin (1998) also proposed several issues for the public to ponder on about the future of DTV. There is first the cost of hardware or service subscription that may scare people away, then the content availability and quality for DTV programs, DTV interactivity back channels, and the possibility of major commercialization problem for DTV.

In May of 1997, Federal Commission of Communication mandated that the United States begin to replace standard analog television with digital television. By 2002, all commercial network stations need to be finished with their digital process, and by 2003, public broadcasters need to get the job done. Viewers will have the options to continue receiving analog broadcasting, or to purchase a digital television or a converter between 2003 and 2006. By then, stations have to return their analog licenses to the federal government. Between now and then, it is advisable for everyone to think about the future of television.

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Utilizing Edutainment to Actively Engage K-12 Learners and Promote Students' Learning: An Emergent Phenomenon

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Abstract

Researchers have claimed that while educational computer software does not necessary improve students' academic performance, it does provide for students a more interesting and motivational environment for learning. It naturally fits in the context of students' learning since it can deliver nonstop actions, realistic sounds and vivid colors to get students' attentions. It also corresponds to the ongoing move towards more student-centered learning (Ellington, 2000). The design of educational computer software adapts games and simulations to help students learn while having fun. Although nowadays at least one computer per classroom is used for instruction and the number of students per computer is decreasing, teachers are facing challenges to utilize educational software to engage students' learning due to the lack of sufficient technology infrastructures, the lack of proper and quality educational software, and the lack of training and support to make utilizations.

This paper will explore if educational software that entertains K-12 students can also promote learning in the practical educational context. Also, this paper is to investigate the emergent phenomenon of whether educational software works as edutainment to facilitate and motivate students' learning, and whether the utilization is implemented in real classroom instruction without obstacles. The ultimate goal of this paper is to explore the emergent phenomenon of utilizing edutainment to actively engage students and promote students' learning.

Introduction

The increased use of computers in education comes along with progressive technology, both hardware and software. It is really easy to discover educational software targeting at K-12 students. The design of educational computer software can be seen as the adaptation of the attributes of games and simulations to help students learn. The manipulation for educational purposes and entertainment is remarked as one kind of edutainment. However, we do not know specifically how students are likely to interact with varieties of educational software in terms of edutainment. Is it for educational purposes or rather for leisure? Furthermore, utilization of educational software in classrooms is not clinical. The exploration of teachers' implementations of educational software for real instruction is rare reported and investigated. It is uncertain how teachers utilize educational software for their teaching. The focus of this paper is a preliminary analysis of at what degree the utilization of edutainment, in terms of educational software, in schools is taken place. We are particularly interested in discovering discrepancies beyond the emergent phenomenon.

Current Status of Technology in K-12

In 1996, President Clinton articulated a clear vision for improving 21st century education through the use of technology in American schools. Defining "Four Pillars" (U.S. Department of Education, 1996) as part of his Technology Literacy Challenge, the President called for broadening educational technology objectives to include not only hardware and connectivity, but also digital content and professional development. The "Pillar" of digital content asserts that effective software and online learning resources can increase students' learning opportunities.

Computers in K-12 public schools

In fact, with student populations growing (NCES, 1997) and many buildings and facilities aging (U.S. General Accounting Office, 1995), every school has its own unique priorities that compete for limited resources. All schools must ensure that the drive to integrate technology does not supplant the fundamental need to provide all students with basic skills such as reading and math although technology can be an effective tool for meeting learning objectives (CEO Forum, 1997). In 1995, reports suggest that nearly 60% of school computer purchases were used to replace old and outdated computers, resulting in only a marginal increase in the number of machines available to students (QED, 1996). In the 1998-1999 school year, the average student to computer ratio was 5:1 and the average student to multimedia capable computer ratio was 10.1:1 (QED, 2000). In the 1999-2000 school year, the average student to computer ratio was 5.4:1 and the average student to multimedia capable computer ratio was 9.6:1 (QED, 2001). The survey results for school year 1998-1999 and school year 1999-2000 were very close showing that no significant increase of computer available to students. The differences were embedded only on the percentages of Internet connection for these two school years. In year 1999, 95 percent of public schools and 64 percent of public classrooms are connected to Internet and have Internet access, and in year 2000, 98 percent of public schools and 77 percent of public classrooms are connected to the Internet and have Internet access (CEO Forum, 2001). Teachers' uses of technology at schools were reported as well but mostly stated as using computers daily for planning and teaching, as using the Internet for instruction, and as using emails. Among above usages, creating for instructional materials using computers accounted for the major utilization (CEO Forum, 2001).

Supports and training for teachers

Scrogan (1989) reported that many teachers wanted to learn more about technology but were unable to find satisfactory instruction. To overcome this, teachers were asking school systems to provide more relevant and consistent training and support for integrating technology into curricular (Becker, 1992). A more recent survey conducted by the National Center for Educational Statistics (NCES, 1999) indicated that less than 20% of current teachers reported feeling very well prepared to integrate educational technology into classroom instruction (Schrum, 1999). In general, K-12 teachers do not receive enough time, access, support, or encouragement to become comfortable with computers (Siegel, 1995). Recent research indicated that although teachers are eager to use technology for professional and curricular activities, a lack of teacher-development programs and time dedicated to experimentation hinder teachers' skills and knowledge (Schrum, 1995; Schrum & Fitzgerald, 1996). Teachers have indicated that their greatest barrier for use of technology is a lack of understanding of how to use it in classrooms (Hancock & Betts, 1994; Becker, 1992). Becker (1992) reported that teachers who had more experience with computers were more inclined to integrate the curriculum across subject areas and use computers as a tool for learning. Koontz (1992) found that teachers with some experience with computers had more favorable attitudes towards technology and were more willing to use technology in their classrooms. Clearly, access to technology and lack of ongoing support are major obstacles for educators interested in implementing information technologies in teaching (Schrum, 1995). Teachers are on their own to make up their decisions whether to use computers to teach and how to utilize computers into lesson activities. Use of computers in instruction tends to be by individual teachers.

Adoption of technological innovation

Rogers (1995) offered a significant review of adoption of technological innovation and found that the adoption depends on the potential adopter's determination of five criteria. These include (a) the relative advantage; (b) the compatibility with personal values, experiences, and needs; (c) the complexity of use; (d) the availability for experimentation; and (e) the observability of results to others. These factors all require attention prior to the initiation of the innovation. Moreover, the CEO Forum has developed the School Technology and Readiness Chart (STaR Chart) to provide a clear framework for assessing how prepared American schools are to meet the education challenges of the 21st century. The STaR Chart describes technology presence, use and integration in a typical school in four school profiles ranging from the "Low Technology" school that uses technology primarily for administrative functions, to the "Target Technology" school that integrates technology throughout the curriculum (CEO Forum, 1997). Beginning from 1997 and for each of the following three years, the CEO Forum would use the STaR Chart as the Backdrop for an assessment of how ready our nation's schools are to effectively use technology to enhance teaching and learning. The STaR Chart is available on-line and is handy to help schools and teachers accessing their readiness and development of technology for the current and future status.

Digital content

Digital learning is an educational approach that integrates technology, connectivity, content and human resources. When implemented correctly, it builds on the unique, dynamic characteristics of digital content to create productive and engaging learning environments (CEO Forum, 2000). Digital content can be randomly accessed, explored on many levels, interactive and engaging, manipulatable and creative. There is more about digital content in the 1997 STaR Report (CEO Forum, 1997):

> The digitization of information has led to more dynamic and interactive education content. Digitization has also transformed the way educators, parents and students use educational content. Not only can information now be packaged by traditional content creators in new and exciting ways - software, CD-ROMs or online resources - but it can also be used and creatively re-packaged by teachers, students and software publishers. In addition, new tools are available in the digital age allowing individuals to find, organize and create information as never before possible. (p. 28)

Assessing the degree to which digital information has been incorporated into classrooms can only be accomplished by examining the availability and use of digital content and digital learning tools (CEO Forum, 1997). The report of CEO Forum (2000) also indicates that people have placed much focus on hardware and connectivity than on digital content and digital learning. It is time for people to refocus on utilization and development of digital content and learning. It is evidenced to tell people's foci from numbers. Average school district spent 11 dollars out of 121 dollars per student on instructional software in the 1998-1999 school year (QED, 2000). Moreover, statistic data often omitted identifying kinds of instructional software in practice.

Instructional computer games as edutainment to students' learning

Educational computer software, as a form of highly interactive technology and a form of digital content, naturally fits in the context of students' learning since it can deliver nonstop actions, realistic sounds and vivid colors to get students' attentions. Educational computer software usually incorporates the nature of games and simulations into its design and development. In other words, while interacting with instructional computer games, students are engaged with education as well as having entertainment. The integration of educational purposes and entertainment turns the educational computer software into the edutainment.

Theoretical framework of games and simulations to students' learning

Dempsey, Rasmussen, & Lucassen (1994) put instructional games into simulations, puzzles, adventures, experimental games, motivational games, modeling and others. Instructional games sever many functions such as tutoring, amusing, helping to explore new skills, promoting self-esteem, practicing existing skills, drilling existing skills, or seeking to change an attitude. Research has shown that games and simulations can make a significant contribution to teaching and learning. The impact of games for education have been studied since 1960's although research did not specify computers as the medium of games. Past research has suggested that games improve student motivation, affective and cognitive learning. Randel, Morris, Wetzel, and Whitehill (1992) examined 68 studies regarding the effectiveness of games and simulations in terms of student performance compared with traditional classroom instruction. Of these 68 studies, 38 delineated no difference between traditional instruction and games and simulations in terms of student performance. However, 22 of the 68 studies demonstrated that the use of games and simulations enhanced student performance, and 12 studies indicated that students reported more interest in games and simulations than in traditional classroom instruction. Ricci, Salas, & Cannon-Bowers (1996) further explained that although games consistently have been found to provide a more interesting approach to learning than the traditional classroom environment, games did not necessarily provide a more effective training approach. In Klein and Freitags' study (1991), they indicated that several researchers proposed instructional games can motivate learners in a practice setting. They thought that games could provide extrinsic motivation for iterative practice and that games could be incorporated into instruction to enhance student attention. Games were motivational because they generated enthusiasm, excitement, and enjoyment and because they required students to be actively involved in learning. Stewart (1997) even made a statement that games could be effective instructional tools that entertain while motivating. Dempsey, Rasmussen, & Lucassen (1994) further suggested that technology-based instructional gaming has a wide spectrum of utility for learning. Ricci, Salas, & Cannon-Bowers (1996) defined computer-based gaming as a "rule-governed, goal-focused, microcomputer driven activity incorporating principles of gaming and computer assisted instruction."

Educational computer games and students' motivation to learn

The purpose of educational computer games is of course to teach, but many teachers found computer games a powerful motivator for initiating the learning process (Stewart, 1997). Students can be focused on the instructional content using an alternative learning mechanism, playing games, to the instructor. More research indicates that using gaming techniques in multimedia design allows students to become actively involved while making the session enjoyable (Metcalf, Barlow, Hudson, Jones, Lyones, Munfus, & Piersall, 1998). Children's interest in computer games and technology may be harnessed to good educational use (Fisher, 1994). The goal is to maintain the student's interest while increasing her/his skills and knowledge. Since learning occurs with repetition, a trainer wants a student to be motivated to come back to the game often. Educational software disguised as games will capture and hold a student's interest. Software that entertains will more effectively communicate its educational message. Compared to learning by rote, learning with colorful, dynamic computer screens will prevail every time (Millman, 1992). Educators should try to create learning environments in which students are allowed to make choices, initiate activities, and view learning as a celebration (Murphy & Thuente, 1995). The impact and implication for the educational context is as Dorman (1997) stated that, the expectation by students, all learning must take a gaming approach and be fun. The idea is to entertain education by edutainment media. Teachers and educators can make ultimate use of novel computer games engage classroom learning with more enjoyable perspectives and with better student motivations. Moreover, Evans (1996) also stated that students' academic performances were not necessary improved because of using computer games. Rather, computer games serve a different purpose. Games are supposed to be fun, get students' attention, keep students on task, and motivate them to be active learners.

Edutainment and the learning environment

Educational software in terms of edutainment, not limited to drill and practice for individual students, supports individual learning activities. While interacting with the educational software, students are taking their own paces to learn and construct their own understandings of the instructional messages that the software introduces. It corresponds to the ongoing move towards more student-centered learning, a move that has been steadily accelerating since the late 1960s (Ellington, 2000). Moreover, adopting computer edutainment to engage students to think and to learn is also an approach of constructivist learning. According to constructivism, the process of how students create meaning and knowledge of the reality is the major concern of the constructivist learning approaches. Instead of focusing solely on individually cumulating the acquisition of facts related to specific subject areas, students have more chances to work in groups and do tasks collaboratively. Students are engaged in making and evaluating their queries to solving complex, authentic problems together. They construct their knowledge based on their interpretations of instances in accordance with the social standards and regulations.

The emergent phenomenon

By reviewing statistics numbers and literature research articles, we found although more computers are available to students, the access and training are not consistent. There have been many attempts to understand patterns of technological adoption in education (Dalton, 1989; Dwyer, Rignstaff, & Sandholtz, 1991). However, the answer remains uncertain on how technology is used, how much it is used, and whether what exists is broken, worn out, or still in unopened boxes (Mehinger, 1996). In addition, adoption and selection of computer games are not required and uniformed to every school. There are no set standards and requirements for teachers to use computer games within or between schools. The choices of the kinds of computer games and simulations schools choose vary greatly. Although people are aware of the increasing popularity of computer games and their abilities to facilitate teaching and motivate learning, there are still obstacles of utilizing educational computer games in schools in terms of hardware infrastructures, software design and availability, and teacher training.

Hardware

Despite the number of students per computer has decreased to five students per computer in 2000 (QED, 2001), most regular classrooms only have one computer available for instruction and mostly for the instructor to use. In other words, it is impossible for the whole class to work with an educational computer game in a regular classroom where hardware is insufficient to provide the opportunity. Therefore, the engagement of computer games for instruction must be taken place in computer labs, whereas time logs of computer labs are full and in use most of the time. Consequently, the availability of hardware is not ready for teachers to apply educational computer games into their regular teaching strategies. The availability of hardware at this point of time can only allow educational computer games as the supplemental instructional materials or extra instructional activities to students. To individual teachers who likely are eager to utilize computer games to facilitate and motivate students' learning, it is not practical to happen in the context of K-12 schools so far. Another problem is that there is a huge amount of outdated computers that are still serving in K-12 schools but cannot run educational computer game software. Glennan & Melmed (1996) indicated in the RAND report that despite there is a rapid growth of innovation and purchasing of computers, the average school still makes limited use of computers and substantial numbers of schools have very limited access to technology of any kind. The platforms in schools are seriously outdated and waiting for replaced.

Software

When choosing educational software to use, teachers usually find it is difficult to have good quality software with desired content specified. Moreover, there are always not enough funds to purchase software. Glennan & Melmed (1996) pointed out that the education software market has had a rapid expansion in home education software; however, the market for school-based content software is modest and comparatively stagnant. Quality content software for K-12 schools is not broadly available since home edutainment materials do not always or readily translate to the classroom. They further explained that the economics of the school market do not work for software developers. It is very critical to gain profits on developing quality content software targeted at school markets. Schools spend very little on software. According to MDR's annual survey of 2001, schools spend 20% of their technology budget on software and spending toward hardware accounts for 67% of total technology spending. The shortage in content software persists. The development of content software for use in schools is a difficult challenge.

Teacher training

When technology is deeply introduced to a school, teachers are required to take new roles and learn new skills. However, research indicated that neither the initial preparation of teachers nor the current strategies for continued professional development have been effective in developing these new requirements (Glennan & Melmed, 1996). Use of technology to significantly affect classroom practice tends to be limited to small groups of teachers who are excited by the potential that they feel technology has to motivate their students or to access new resources (Glennan & Melmed, 1996). Most teachers have little formal instruction on how to use technology or how to select proper types of software to help them teach. The lacks of continual teacher training on technology and supports on utilizing technology have made some teachers with novice technology competence step back to what they are more familiar with, the traditional instruction method. According to MDR's annual survey of 2001, average schools devote 14% on professional development. There must be many schools allocate less than 14% of the whole technology budget on professional development. A survey revealed that teachers are less likely to have had training in more advanced technologies, such as multimedia computers and the Internet (Jerald, 1998).

Conclusion

Despite more and more educational software are getting available with good qualities in the market and despite the positive stimuli that educational software brings to students' learning, the fundamental focus should be whether or not the schools, teachers are ready to utilize it to facilitate teaching and learning in terms of hardware infrastructure, software adaptation, and teacher preparation. As Glennan & Melmed (1996) stressed there are two particularly important incidences, equipping teachers to effectively exploit technology for the benefit of their students and assuring a plentiful supply of high-quality content software. The readiness of all aspects is the key to the successful utilization.

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Cognitive Presence in Web-Based Learning: A Content Analysis of Students' Online Discussions

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Abstract

This first phase of a content analysis of online, asynchronous, educational discussions is designed to generate a method for automatically categorizing messages into cognitive categories using neural network software. This phase of research answers two questions regarding the method of automatically analyzing discussion messages: Can a neural network reliably categorize messages under optimum circumstances, and how can the method be improved to generate greater reliability? To determine whether neural network software can reliably categorize messages, two trials were conducted. The first, "best fit" trial, a proof of concept trial comprised only of messages which best fit the categorization model, generated strong reliability figures (CR = 0.84; k = 0.76), and the second, systematic sample, a sample much more indicative of the messages generated in an online educational discussion, produced formative reliability figures (CR = 0.68; k = 0.31) from which the method of analysis may be optimized. This analysis also provides a distribution based on cognitive presence categories and subcategories of one semester of graduate online educational messages.

Many universities and K-12 educational settings have adopted online, web-based instruction as a tool for delivering instruction. According to Green (2000, para 7), "Today, 75 percent of two- and four-year colleges offer some form of online education. By next year, that number will reach 90 percent." Hamm (2000, para 8) makes a slightly more conservative claim by quoting a study performed by the Chronicle of Higher Education: "60% of American colleges and universities offer online-learning programs, and 8% more plan on doing so in the next year." He also notes that the e-learning market is expected to grow from $1.2 billion in 2000 to $7 billion in 2003. Certainly, online delivery of instruction is growing as are fora whereby students engage each other. WebCT, one of the more popular suite of tools to support web-based collaborative learning boasts 1600 new installations in the past 18 months and nearly 11 million student accounts (Goldberg, para 3). Although there is no clear data on the number of students participating in online courses in which every transaction is electronic, there appears to be a migration away from courses delivered solely face-to-face to those either supplemented with or completely reliant on online discussion. This migration toward electronic classrooms means that the discourse from these learning environments is very easily captured providing an opportunity for researchers to study the process of learning in a way that has never been available before. Never before have we had access to electronic texts containing virtually every exchange made by every student for an entire term. Concurrently, our ability to use computers to process text and reveal underlying themes has steadily grown (Rife, Lacy, & Fico, 1998). The convergence of these two realities brings us to our current state in which we have numerous texts available, a growing set of analysis tools, but very little research to explain the phenomena that take place in the course of learning. Kuehn (1994, p. 172) also highlights this dilemma, "few researchers have adopted current communication theory to investigate computer impact or effects in instructional settings...."

Despite the availability of electronic discussion list texts, few analyses of the content generated by students have been conducted. A content analysis type of inquiry allows us to describe how students engage and generate material within an online setting thereby providing potential answers to questions such as: Does a chatroom conversation produce different cognitive results than either a teacher-led asynchronous discussion or a student-led asynchronous discussion? Henri (1992) makes apparent the role content analysis has to play in an instructor's ability to guide learning:

> Content analysis, when conducted with an aim to understanding the learning process, provides information on the participants as learners, and on their ways of dealing with a given topic. Thus informed, the educator is in a position to fulfill his main role, which is to offer immediate support to the individual and the collective learning process. (p. 118)

Over all, this study outlines the initial phase of the construction and use of a neural network to perform a content analysis of a large body of student messages for cognitive presence, one portion of Garrison, Anderson, and Archer's (2000) model to understand online learning environments. This type of tool may ultimately be used to gauge, guide, direct, and manipulate the learning environment. Despite Howell-Richardson & Mellar's (1996) research indicating that modifications to the structure of an online course produce significantly different communication outcomes, instructors currently have little ability to gain a bird's-eye view of the overall learning taking place, much less an ability to respond to that learning, assess it, or intervene. This research seeks to answer two questions. First, can neural networks be used to analyze and describe the cognitive landscape of online educational discussions? Second, at this phase, how is cognitive presence displayed in an online course?

Theoretical Background

Cognitive Presence

Garrison, Anderson, and Archer (2000, 2001) have developed a community of inquiry model, based on Dewey's (1933) practical inquiry model, which splits community-based learning into three overlapping areas: social presence, cognitive presence, and teacher presence. They operationalize cognitive presence by splitting it into four phases: triggering event, exploration, integration, and resolution, and use the following descriptors respectively for each phase: evocative, inquisitive, tentative, and committed. Specifically, cognitive presence is defined as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (p. 11). Garrison et al. employ their cognitive presence model to analyze an online discussion group. Their unit of analysis is the entire message mainly because messages are easiest to identify and occur naturally in discussion environments. Because a message may contain indicators for multiple phases, they have developed two heuristics for deciding which messages fall into which categories: code down and code up. They used human coders to classify messages, and this yields a reliability figure (k=0.74) which Riffe, Lacy, and Fico (1998) accept only for research that is breaking new ground, a category under which this research clearly fits. Also, they found that the greatest coding discrepancies occurred between coding for exploration and integration. They admit low occurrences of resolution and believe higher instances of resolution will be found "where applied knowledge is valued—particularly adult, continuing, and higher education" (p. 16)

Can Neural Networks Analyze Messages?

The use of neural networks in educational settings is rare and there are no accounts outlining the use of a neural network to analyze text messages of an online discussion group. Garson (1998) provides a number of reasons why social scientists have not adopted the use of neural networks in their research. First, neural network software has been available to the social scientist only since the early 1990's. Second, it is not clear how neural networks arrive at their conclusion; unlike an expert system, neural networks provide no audit trail outlining their reasoning. Also, neural network techniques are complex and leave researchers unsure whether their analysis is truly optimal; slight modifications to a number of parameters may yield a more optimal analysis. Nonetheless, neural networks are good at making predictions (e.g. stock market forecasting) and at classification. Garson cites 34 research studies using neural networks in economics and business, 9 in sociology, 7 in political science, and 45 in psychology (Garson, 1998, pp. 8-22).

Given a high enough reliability value, neural networks have the ability to classify large quantities of data which, for the present study, means that researchers do not have to sample a subset of all online messages from a course. Instead, the neural network classifies each message thereby eliminating sampling error. In comparison with statistical methods of analysis, Garson (1998) mentions:

> [N]eural models may outperform traditional statistical procedures where problems lack discernible structure, data are incomplete, and many competing inputs and constraints related in complex, nonlinear ways prevent formulation of structural equations, provided the researcher can accept the approximate solutions generated by neural models (p.1)

Clearly, student messages are filled with competing inputs related in a complex, nonlinear fashion. Further, traditional textual analysis of this type would require the use of multiple human coders classifying each message against a set of classification criteria, a resource-intensive technique which also generates approximate solutions.

Method

The method involves four steps starting with a text-based transcript of an online discussion and ending with the calculation of reliability statistics.

Database Creation

First, one semester's worth of asynchronous, online discussion messages were converted from a single text file containing all messages for one semester into a database such that each record represented one message and contained the message body, author, date, etc. This task was accomplished using SQL Server and a series of SQL statements to populate the database. These generic tools were used to streamline the process of making them publicly available over the World Wide Web.

Word Count Tool

Second, a tool was constructed to page through each message body and perform word counts in both self-defined and General Inquirer categories (see Danielson & Lasorsa, 1997; http://www.wjh.harvard.edu/~inquirer). The categorical word count procedure results in a database table with categories as columns, individual messages as records, and cell values representing the count of terms from each cognitive presence category. Self-defined categories allow researchers to define specific indicators for each category. For example, items falling into the cognitive presence phase "integration" often refer to previous messages or draw from a course participant's prior knowledge; therefore, typical "integration" messages incorporate terms and phrases such as "thanks," "that reminds me of," "compared to," and "I agree." The researcher may create one or a number of categories that serve as indicators that a message should be categorized as an integration message. This tool not only allows for the creation of new, user-defined input categories but also incorporates existing input categories from the dictionary of terms found in the General Inquirer. This dictionary is comprised of 11,788 words in 182 categories. Each message was analyzed against each self-defined and General Inquirer category of terms and a simple word count was taken to determine the weight of each category of terms in each message. .For example, the General Inquirer category "positiv" contains the words "up, abide, and yes" meaning that the following sentence will receive a "positiv" score of two: "Yes, I had to look up to see the icon." Further, the "positiv" score of 2 is normalized so the neural network can accurately compare scores across messages. Normalization is performed by dividing the number of times the terms in a single category appear in a message by the total number of words in the message (2/10 = 0.2).

Neural Network Training

Third, a feedforward, backpropagation, neural network was trained to classify each message as falling into one of five categories (triggering event, exploration, integration, resolution, or noncognitive). This was done by human-classifying a group of messages to be used as the training set, training the neural network on that set of messages, and then classifying a second set of messages for reliability purposes.

Reliability Measures

Fourth, reliability measures were taken comparing human-coded messages with those classified by the neural network. Huck (2000) recommends the use of multiple reliability measures for a single study (p. 98). For this reason and because this study replicates a similar study by Garrison, Archer, and Anderson (2001), two reliability measures were employed: Holsti's (1969) coefficient of reliability (CR) which measures the agreement between two coders divided by the total number of messages analyzed and Cohen's kappa which corrects for chance agreement among coders. The difference between the Garrison et al. study and this one is that Garrison et al. performed a human – human comparison whereas this study performed a neural network – human comparison.

Results

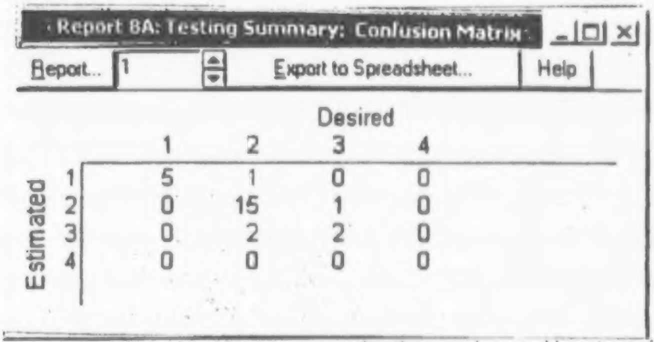
To determine whether the neural network analysis produces results comparable to human-coded content analysis, benchmarks from a human-coded content analysis by Garrison, Anderson, and Archer (2001) were compared to results from this neural network analysis. Garrison et al. went through three phases of training human coders to reliably categorize messages and used both Holsti's (1969) coefficient of reliability (CR) and Cohen's (1969) kappa (k) to measure inter-rater reliability. Garrison et al. generated the following reliability figures:

Reliability Measure	Trial 1	Trial 2	Trial 3
CR	0.45	0.65	0.84
Kappa	0.35	0.49	0.74

Table 1. Reliability measures for Garrison, Anderson, & Archer's (2001) content analysis of an online discussion.

Best Fit Sample

The analysis using the neural network to classify messages is a multi-phase process of which this paper presents the first phase. This phase seeks to answer whether it is possible at all for a neural network to classify messages. In this phase, the messages best representing each category were coded and used to train and test the neural network model. This "best fit" trial yielded the following reliability figures: CR = 0.84 and k = 0.76. This test set (n=26) of optimal messages generates the following matrix after being run through the trained "best fit" model.



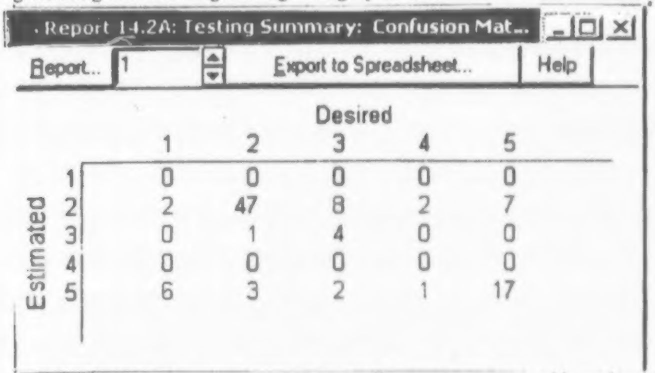
Estimated \ Desired	1	2	3	4
1	5	1	0	0
2	0	15	1	0
3	0	2	2	0
4	0	0	0	0

Chart 1. The desired results are compared to the neural network's estimated results, and the numbers appearing diagonally indicate that the neural network matched the coded test set of messages.

In this set, 1 indicates a triggering event, 2 is an exploratory message, 3 is an integration message, and 4 is a resolution message. This trial indicates that a neural network can reliably discern the first three categories.

Systematic Sample

The purpose of the "best fit" trial is to determine whether a neural network can be used to categorize text messages at all; the second trial uses a systematic sample of messages in which both the training set (n=100) and the test set (n=100) are a systematic sample of every 20 messages. There are 1,997 messages in all; therefore, this sample represents a cross-section of messages occurring throughout the term. Further, this sampling technique introduces noise into the analysis; to accommodate for this, a fifth (noncognitive) category was used. This category represents non-cognitive messages (e.g. greetings and short agreement messages), course management messages (e.g. "When will the textbook be available," or "when is the next chat?"), and technical support messages (e.g. " I can't get into the chat room," and "Why are my messages not showing up on the discussion list?"). A neural network trained against 100 messages using all five categories yielded a CR value of 0.68 and a kappa value of 0.31 generating the following message category results:



Estimated \ Desired	1	2	3	4	5
1	0	0	0	0	0
2	2	47	8	2	7
3	0	1	4	0	0
4	0	0	0	0	0
5	6	3	2	1	17

Chart 2. The introduction of a fifth (miscellaneous) category adds real-world noise to the neural network analysis.

Finally, the systematic sampling of 20% of the messages from the term provides insight into the cognitive effort displayed by the course participants. The first chart displays the percentage of messages by broad cognitive category type, and the second displays messages by the subcategories which make up each category type.

Cognitive Presence by Category	**Percentage**
Not Cognitive	48%
Triggering Event	3%
Exploration	39%
Integration	9%
Resolution	1%

Table 2. Messages by cognitive presence category.

Cognitive Presence By Subcategory	**Percentage**
Not Cognitive	
Unrelated	20%
Course Management	12%
Technical Support	12%
External Reference	4%
Total Not Cognitive	48%
Triggering Event	
Recognizes Problem	1.5%
Puzzlement	1.5%
Total Triggering Event	3%
Exploration	
Personal Narrative	6%
Information Exchange	12%
Brainstorming	5%
Divergence Among	4%
Leap to Conclusion	5%
Suggestion	6%
Divergence Within	1%
Total Exploration	39%
Integration	
Creating Solutions	0.5%
Synthesis	1.5%
Convergence Within	2%
Convergence Among	5%
Total Integration	9%
Resolution	1%

Table 3. Messages by cognitive presence subcategory.

Discussion

Findings

The first trial indicates that in the absence of noise, a neural network can be used to categorize messages into the cognitive categories outlined by Garrison, Anderson, and Archer (2001) based on linguistic cues. In the trial which introduced the noise which naturally occurs in discussion lists, we see that the model overgeneralizes on categories two (exploration) and five (miscellaneous), that it undergeneralizes on integration messages, and that it does not discern triggering events and resolution messages from the others. These findings provide critical, formative information which can be used to optimize and therefore improve the model. Methods for improving the model's ability to correctly categorize are outlined below.

Optimization

Just as Garrison et al.'s coders optimized their coding algorithm between times they coded, the neural network method of analysis may also be optimized. The above reliability reflects an initial brute-force analysis of each message and takes as input weights generated by analyzing each message against a category of terms in the General Inquirer dictionary. The following steps may be taken to improve the model:

Word sense disambiguation: This simply means that individual words are classified according to their parts of speech. For example, the word "test" may be used as either a verb or a noun, and a word sense disambiguation routine will clearly separate those instances of "test" that are nouns and those that are verbs. This should dramatically reduce the amount of noise in the database.

Increased training set: The next phase of this research is the analysis of six eCore courses, online post-secondary, core curriculum courses offered by the University System of Georgia. In this phase of research, six instructors will analyze 200 messages each thereby generating a training set of 1100 messages. In comparison, the current research used 100 messages as its training set and 100 messages as a test set. Building a model from 1100 coded messages should improve the generalizability of each category and therefore the model's ability to correctly classify messages.

Message hierarchy metainformation: In the current model, the only hierarchy information fed into the neural network is whether each message is a reply to another message or not. Garrison et al.'s model indicates that messages are partially classified not only based on their textual content but on their place within a given thread hierarchy. If a message is the first in it's thread

hierarchy, it is most likely a triggering event. If it is near the beginning of a thread and is a response to another message, it is most likely either an exploratory or integrative message.
Improved categories: Create subsets of each category that are very specific, and ensure that each message fits cleanly into a category.

Cognitive Presence Distribution

The distribution of messages into cognitive presence categories is similar to that found by Garrison, Anderson, and Archer (2001) in that a majority of messages fell into the exploration category with fewer integration messages, only a few triggering events, and practically no resolution messages. The discussion topics and goals of the course define the distribution we found. The goal of the course is to give each student experiential knowledge of web-based learning. It is up to the instructor to define whether resolution can practically be achieved in the course; resolution is usually reserved for more practical tasks in which students state that they have resolved an issue which means they have applied knowledge in a real-world setting and have found that the real-world outcome affirms knowledge gained from the course. Although students were creating their own web-based learning modules, these modules were not intended to be the product of a learned body of knowledge; rather these modules were intended to be tasks from which questions emerge. Given this course structure, it makes sense that resolution is rare and exploration dominates. Interestingly, the number of triggering events is fairly low which may also be attributed to the course structure; students were not given a formal triggering event or question by the instructor each week; instead, the instructors allowed the students' exploration to define the direction of the course. In this case, triggering events were more likely to be found embedded within exploratory messages. Tracing triggering events may be assisted by the creation an overall diagram of the course structure allowing us to see not triggering events as defined by the linguistic cues within the message but rather as defined by the messages emanating from these triggering events. That is, if we find that one message spawns a critical debate, then we may in retrospect define that message as a triggering event. This information can be displayed graphically for use by those coding the training set of messages and numerically for use by the neural network.

The Next Phases of this Research

It is expected that a well-trained neural network will perform just as reliably as a set of human coders at classifying messages into cognitive presence categories. This method of analysis will then provide a broad overview of the cognitive effort displayed by students throughout the semester and allows for instructors to make adjustments to their approach in order to bring about desired displays of cognitive effort. Further, this rapid analysis method provides a tool instructors may use to conduct their own research on finely grained aspects of the cognitive dynamics of a course. This method may allow us to answer questions such as: Which displays of instructor involvement generate exploration and which generate integration? Are socially engaged students also cognitively engaged? How many course participants is optimal for higher order thinking? Which class participants encourage the integration of ideas?

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The Application of Carl Rogers' Person-Centered Learning Theory to Web-Based Instruction

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Abstract

This paper provides a review of literature that relates research on Carl Rogers' person-centered learning theory to web-based learning. Based on the review of literature, a set of criteria is described that can be used to determine how closely a web-based course matches the different components of Rogers' person-centered learning theory. Using the criteria based on Rogers' learning theory and the person-centered model of instruction developed by Miller and Mazur (2001) a case example of a web-centric course is evaluated.

Relevance of Rogers' Approach to Learning for Web-based Instruction

Education through the years has integrated new technologies to enhance the learning experiences of students. During the twentieth century we have seen the advent of technologies such as projection systems and television expanding educational capabilities beyond the face-to-face classroom setting to teaching at a distance. The 1990s ushered in the World Wide Web (WWW), a technology expanding the capabilities of teaching at a distance possibly as much as television and projection systems expanded education in the twentieth century. While the WWW has expanded the possibilities of education it is also moving educators to consider new ways of teaching and learning because the WWW has literally created a new type of learning environment with possibly as much potential for student learning as a traditional classroom.

Many educators and researchers have begun discussions about the potentials for learning as well as some of the outcomes experienced through web-based instruction. Some of the outcomes discussed are the aspects of active participation shown by students in web-based learning environments (Brown, 1997; Greening, 1998; Oliver & Omari, 1999), the construction of knowledge (Stefanov, Stoyanov, & Nikolov, 1998), problem solving (Corren-Agostinho, Hedberg, & Lefoe, 1998; Oliver & Omari, 1999), students leading the learning (Berge, 1997; Bonk & Cummings, 1998; Stefanov et al., 1998), and teachers acting as facilitators (Brown, 1997; Stefanov et al., 1998). The outcomes mentioned in many articles on web-based learning studies such as Chalmers' (Chalmers, 1997) and Lazlo and Castro's (Laszlo & Castro, 1995) articles can be identified as components of learning as described by Carl Rogers' person-centered learning theory.

Individual Learning in Web-based Environments

Because the WWW is based on hypertext, which is words and images linked by multiple paths (Landow, 1997; McKnight, Dillon, & Richardson, 1996), the learner selects the paths to explore and thus discovers new links of information. It is through the linking of these multiple paths of the hypertext environment in which students become active participants in the construction of knowledge and meaning (Brown, 1997). Another aspect of the Web affecting learning is the ability to enter or leave at any point within the Web. While there are often centralized information centers, a user can often find information from any access point based on their own investigation and experience (Landow, 1997). Student explorations of web-based information will not only help them become active learners but it will also generate attitudes for personal development. These explorations allow learners to pick and choose where they want to go and what they want to learn as well as determine the importance of the information found. The learning possibilities could increase the potential impact on areas such as self-esteem, self-control, self-efficacy and motivation (Laszlo & Castro, 1995).

Collaborative Learning in Web-based Environments

While the WWW can provide opportunities for individual active learning it can also provide opportunities for collaborative learning and the development of learning communities. Using the WWW and the various forms of communication available on it, students can learn through group-based assignments, research projects, and presentations. Collaborative learning on the web can enhance the learning experience for the students more so than individualistic learning on the web because it could create a more communal or team atmosphere. Chickering and Ehrmann (1997) found that working with others increases involvement in learning because good learning is collaborative and social not competitive and isolated. While increasing student involvement, the web also allows the students to assist each other in the exploration of answers to areas of common interest, share constructed knowledge and interpretations of knowledge, and build upon that knowledge through feedback from peers (Graham & Scarborough, 1999; Harasim, 1990).

While collaborative learning can occur just as easily in a face-to-face situation there are some advantages to web-based collaborative learning. Collaborative learning on-line can be done either in a same time/any place situation (synchronous communications) or in an any time/any place situation (asynchronous communications). Using asynchronous communications the learners are allowed to respond at a time most appropriate for them, which can allow for opportunities of reflection. The potential for anonymity of the contributors, can also be a great equalizer when learners will not need to struggle for their chance to speak, and everyone can make a contribution that will be "heard" by all class members (Brown, 1997). Anonymity can also allow learners to feel that they can be open to expressing their opinions in an open environment allowing better comprehension and affirmation, which are key behaviors at the core of collaborative communication (Zimmer & Alexander, 1996). To ensure development of a learning community the individuals will need to develop and maintain a group environment with all members assuming at least some of the responsibility for the environment starting initially with the facilitator (Armstrong & Yarbrough, 1996).

The Need for a Change in Web-based Learning Environments

While web-based learning environments seem attractive in their potential to widen the scope of users' experiences, these new technologies also have the potential to create artificial and possibly depersonalizing social circumstances through the lack of communication. In the past one of the largest complaints from students in distance education situations is a sense of alienation that leads to dissatisfaction of the learning experience (Biner, Dean, & Mellinger, 1994). In a web-based learning experience it is necessary for the instructor to establish and facilitate continual lines of communication so that students do not feel that they are all alone. Another change that is needed for web-based learning is the locus of control. As in the past, when new interactive technologies are introduced into learning contexts, the role of instruction and the instructor needs to be examined. In web-based learning environment the locus of control shifts from the instructor to the student due to the environment. This change will reflect less control on the part of the instructor as he/she facilitates the learning learners' opportunities for controlling more of their own exploration and interaction. Instruction enhanced and shaped by facilitation may be a key to web-based learning environments because students will need specialized guidance exploring their on-line learning contexts. These needs are all focused upon in the person-centered learning theory developed by Carl Rogers.

Carl Rogers' Person-centered Learning Theory

When Rogers wrote Freedom to Learn (1969; Rogers & Freiberg, 1994) he focused on traditional schools but saw the person-centered educational approach developing its strongest roots in alternative schools and universities without walls. While many instructional theories focus on the learners' achievement of specific learning objectives, Rogers' learning theory focused on a goal of helping the learner learn how to learn. Rogers felt the learner would become a freely functioning, self-enhancing, self-actualizing, creative, and dependable person with this focus.

Carl Rogers claimed he developed his person-centered theory because we live in a constantly changing world and as people in this changing world, we need to be willing to change our thinking to adapt to these changes. More importantly, students need to learn how to learn in order to adapt to the different types of learning required in a variety of settings and for a myriad of purposes. Rogers boldly suggested the facilitator should encourage the learners to charge off in new directions dictated by their own interests and to unleash their sense of inquiry and exploration (Rogers & Freiberg, 1994).

Rogers' model theorizes a person emerging from therapy or from the best of education has experienced optimal psychological growth meaning the learner is able to freely function in all of his or her potentials, self-enhancing, continuing to develop, and always seeking newness in each moment, resulting in a more self-actualized person (Rogers & Freiberg, 1994). Maslow (1970), describes this self-actualized person as someone who has developed or is developing into the full stature of which he or she is capable. The development of a self-actualized person through the person-centered theory is important in education because one goal of education is to develop learners into whole people. The learners will become people freely functioning in all aspects of love, feeling, and creativity. Of importance, is that these people may continue to learn through life rather than becoming automatons able to recite the information provided to them (Patterson, 1973).

Another aspect of the person-centered learning theory connected to self-actualization is that person-centered learning experiences help the learners become a more creative (Patterson, 1973). As a learner becomes more self-actualized he or she will be able to perceive reality more accurately, accept himself or herself and others, become more spontaneous, independent, and more creative (Davis, 1992; Maslow, 1970). As the learner understands himself or herself more he or she will be able to make meaning of the world as well as become more understanding of varying views and perspectives.

While the development of self-actualized people, who are life-long learners, is a commendable goal how can this goal be achieved? First, a teacher should realize that the only person who can reach the goal of becoming a self-actualized person is the individual learner. Second, unlike in some instructional methods of providing the knowledge to the learners, the teacher in a learner-centered environment becomes a facilitator of the learning the students themselves conduct. It becomes an experience of significant learning because the individual initiates it, allowing the individual to provide personal control and the element of learning is built into the whole experience (Sahakian, 1970).

It is important for the teacher to facilitate the learning and allow the students to be challenged to think for themselves rather than being given information (Rogers & Freiberg, 1994). There are several tasks a teacher should do when positioning themselves in a facilitator role instead of a traditional teacher role. The first is to set the mood for the environment. There should be a sense of cooperation and trust within the group. A competitive attitude among members of the learning group will disrupt the sense of trust and cooperation. Next, the teacher as facilitator should make themselves available as one of many resources of information rather than as the main source of information for the students. Most importantly though, the teacher as facilitator should be aware of the attitudes he or she holds. The teacher needs to feel acceptance of his or her own feelings thus becoming a real person in relationship with the students (Rogers, 1961). It is important for the teacher to show realness as a person or in other worlds showing his or her self-actualization because if the goal is to help the students learn how to learn and become more self-actualized, the teacher needs to be self-actualized to foster it in others (Patterson, 1973). The characteristics Patterson describes was also found when Rogers and Freiberg (1994) talked to students and found that students wanted many of the same tasks required of a facilitator. They discovered that students want to be trusted and respected, wanted freedom, a place where people care, chances to make decisions, teachers as helpers, and teachers who help them succeed (Rogers, 1961).

How Does Rogers' Person-centered Learning Theory Fit with Web-based Learning?

How does Rogers' person-centered learning theory apply to web-based learning as currently many web-based courses could fit well under the problem-based constructivist instructional model? Rogers' theory would work with web-based courses on several levels. The first is Rogers felt his theory of learning was most applicable in non-traditional classes (Rogers & Freiberg, 1994). Most people would agree web-based courses fit into being non-traditional classes. Many web-courses also meet the needs of a person-centered learning theory because the teacher assumes the position of a facilitator rather than the traditional role of knowledge giver. As the teacher takes on the role of facilitator the students take on the roles of knowledge seekers as they focus on what they want to learn within the class topics. The roles of teacher and students is the key focus of Rogers' person-centered instruction because Rogers believed that the student should be the center of instruction and should conduct the learning thus providing personal control into the experience of learning (Rogers & Freiberg, 1994; Sahakian, 1970).

The major focus of Rogers' learning theory is that the learning should be student directed and web-based courses provide a fertile ground for student directed learning. The nature of the World Wide Web puts learners in a situation where they will search for information. Through their searches they will experience success and failure, but it is the experience of directing their own individual learning that promotes a growth of self. This growth will allow students the opportunities to learn the process of learning firsthand and allow them to further develop themselves into their fullest potential as human beings.

Criteria for Evaluating Web-based Courses Consistent with Rogers' Approach to Learning

Using Rogers' person-centered learning theory I have developed nine criteria to determine if a web-based course fits with Rogers' approach to learning (See Table 1). These criteria are based on a person-centered instructional design model developed by Miller and Mazur (2001). Using these criteria, an evaluation of a course can be made to determine if it meets the needs stated by Rogers of a person-centered learning experience. The criteria can be used to not only determine if a class is consistent with a person-centered focus but also can help instructors and instructional designers enhance classes to fit closer to Rogers' approach to learning.

Table 1. Person-centered Instructional Approach Criteria for Web-based Courses

Criteria	Criteria Description
1	The course provides an emphasis on the learners' interests, personal ability, and prior knowledge of the instructional topic.
2	The facilitative instructor should connect students' knowledge and interests with content principles of the course.
3	The facilitative instructor should select an environment that supports collaborative learning and learner control.
4	The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.
5	The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.
6	Learners work with the facilitative instructor to organize the areas of interest to cover so he or she can meet the needs of the students' learning objectives and maximize the learning potential.
7	Learners work with the facilitative instructor to organize the areas of interest to cover so he or she can meet the needs of the students' learning objectives and maximize the learning potential.
8	The learners conduct self-evaluation based on their individual learning objectives outlined in their learning contracts. The self-evaluation should show the significance of the learning experience and could also provide focus on levels of personal involvement, self-initiated involvement, and learners' pervasiveness.
9	Outcomes of the course should show significant learning. This could include an accumulation of knowledge on the topic, satisfaction in the learning, desire to master the experience, and a greater understanding of any problems and potential resolutions within the content. The learner should also experience increased levels of self-actualization.

Case Study Example of the Application of the Person-centered Learning Criteria

Description of the Video for Distance Learning and Multimedia Course

The course I selected as an example of the application of applying Rogers' person-centered instructional approach to a web-based course was on video design for distance learning and multimedia that was taught during the Spring 2000 semester. The case example course was a graduate level course offered as an elective in an instructional design program from a southeastern university. The purpose of the course was to discuss a variety of video applications for multimedia development and distance education. The course was framed around concepts and principles of film theory and cinematic narrative research and used classroom exercises and projects focusing on basic video and video production skills to enhance multimedia and distance education course development.

The course is described as "web-centric" due to a majority of the course materials being available from the course web site however the course does include four "face-to-face" meetings during the semester. The web site provided web-based mini-lectures, relevant web-site links, and a threaded discussion feature for discussions of course readings and collaborative interaction. While the class did meet in a face-to-face setting four times during the semester, students could attend class at the specified site or they could attend via 2-way compressed video hook-up. This attendance option allowed students outside the central Kentucky region to take part in the class without coming to the class meeting site. Based on the web-centric format of this course, I felt this would be an appropriate candidate for evaluation based on a Rogerian approach to learning. The evaluation was conducted by reviewing the course syllabus, course documents, and a brief interview with the course instructor. Each of the nine criterion are presented in italics followed by a statement of meeting or failing to meet the criterion and a brief description of how the course meets or fails to meet the criteria.

Case Study Evaluation Results

Criterion 1: The course provides an emphasis on the learners' interests, personal ability, and prior knowledge of the instructional topic.

The course met criterion 1. The course needs to accommodate a wide range of skill-levels and abilities students bring to the course. The instructor developed three areas or constellations, as called in the course, based on conceptual, technical, and application skills to meet these needs. Each constellation listed topics students could select and focus their personalized instruction upon during the course. An example of this selected focus was the technical constellation, which required students to choose 5 out of 12 technical areas they wanted to master within the course.

Criterion 2: The facilitative instructor should connect students' knowledge and interests with content principles of the course.

The course met criterion 2. The application constellation of the course required students to select 2 out of 6 topic areas with one of the topics required of all students connecting the technical areas students focused on mastering within the course.

Criterion 3: The facilitative instructor should select an environment that supports collaborative learning and learner control.

The course met criterion 3. Because the class only met face-to-face four times during the semester the teacher used a threaded discussion list on the Nicenet web site (http://www.nicenet.org). This site allowed the instructor to create discussion topics, post questions, and moderate online discussions with the students. Using the Nicenet threaded discussion list, the students were able to post messages to other students and the teacher either publicly or privately.

Criterion 4: The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.

The course met criterion 4. The course met this criterion by allowing students to set their objectives by selecting topic areas that would help them at their present skill level or help them to advance to a higher skill level using the technologies available to them.

Criterion 5: The facilitative instructor allows students to develop forms of self-evaluation to demonstrate significant learning based on the individual students' learning objectives.

The course did not meet criterion 5. While the course had been designed to allow students to develop individually achievable objectives there were no opportunities within the course that allowed students to develop personalized forms of self-evaluation to demonstrate significant learning. The instructor set the evaluation methods used within this course.

Criterion 6: Learners work with the facilitative instructor to organize the areas of interest to cover so she can meet the needs of the students' learning objectives and maximize the learning potential.

Based on the evaluation using only publicly available course information and a brief interview with the instructor the course cannot be evaluated on criteria 6. To answer this question it would be necessary to conduct observations of the interactions that occur in the learning environment.

Criterion 7: The facilitative instructor identifies, selects, and presents to the learners resources to enhance their learning experience.

The course met criterion 7. The instructor provided a links page off of the course homepage listing several web sites providing additional learning resources for the students. The instructor also provided a course video with instructional clips as well as several mini web lectures students could access to help with their understanding of the required course text.

Criterion 8: The learners conduct self-evaluation based on their individual learning objectives outlined in their learning contracts.

The course did not meet criterion 8. There was no information provided about learners conducting self-evaluations. Based on the available information the instructor evaluated students based on class participation, technical and application constellation exercises, and the final project.

Criterion 9: Outcomes of the course should show significant learning.

The course met criterion 9. The course had been offered for three semesters with the constellation first being introduced in the second semester offered. Students rated the course during the initial semester at 3.6 of a possible score of 5.0. The second semester using the constellation approach has reached a 4.2 out of a total of 5.0. The instructor also found a high quality of work in the video products presented by the students. The students of the second semester also suggested additional constellation activities that have been incorporated into the course. The suggested activities showed that students were interested in further accumulation of knowledge on the topics and wanted to suggest the learning opportunities to help future students.

Summary of the Course Evaluation

Overall this course promotes a Rogerian approach based on the criteria developed for evaluation. Based on information available for the evaluation, the main area of concern for this course using a person-centered instructional mode was the lack of student-developed forms of self-evaluation and a major focus on teacher evaluation of student progress. To allow students to feel they are developing their own learning objectives it would be recommended to also allow students to develop individualized evaluations of their performance. Although the course does not meet all of the criteria, there has been an obvious change in the satisfaction of the course based on the increase of course ratings since the constellation approach was used. The increased course ratings met one of the components of significant learning, which can promote increased interests in the topics and increased levels of self-actualization within the students. Based on the results of this case evaluation, specifically the outcomes that were reported from the instructor it can be inferred that providing the course with a Rogerian person-centered focus increased the potential for positive outcomes.

Conclusions

Several conclusions have been made from the application of the Rogerian person-centered criteria to a web-based course. The nine criteria posited in this paper can be used to identify the extent that a web-based course fits with Rogers' person-centered learning theory. Using the person-centered learning criteria can be used to help adapt the instruction of the course to fit a full model of person-centered instruction such as Miller and Mazur's person-centered model of instruction (2001). It is necessary to conduct additional research into the impact of person-centered instruction such as Miller and Mazur's model (2001) on web-based courses. It will also be necessary to begin studying what types of instructional models work best in web-based instructional learning environments.

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ANALYZING TEACHER PREPARATION
TO INTEGRATE TECHNOLOGY
IN CLASSROOM INSTRUCTION

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Abstract

What is not fully understood about educational technology is how to transform computer technology into a powerful pedagogical tool. One way to address instructional issues associated with integrating computer technology in classrooms is to analyze educational best practices associated with technology integration in classrooms. Technology standards for teachers were established and a tool to examine the quality of computer technology integration was developed and validated for a school district undertaking a district-wide technology professional development initiative. Pattern analysis procedures demonstrated that the measure was appropriate for determining the extent of technology integration and for identifying appropriate technology training themes.

Several national organizations are currently involved in the establishment and proliferation of national technology standards for teachers including the International Society for Technology in Education (ISTE) and the National Council for Accreditation of Teacher Education (NCATE). Although many reasonable and appropriate technology standards for teachers exist, these goals are often stated in abstract or general terms. Additionally, since there is a great deal of variability in educational beliefs, technological availability, and state and community expectations, technology integration should be locally defined, using available research models and national standards as a foundation (Pierson, 2001).

We launched a technology professional development initiative in a school district by establishing a set of technology standards and indicators that clearly described educational best practices for teaching and learning with technology that teachers could implement in their classrooms. The technology standards on which the professional development model was established was formulated by synthesizing national, state, and local technology standards and then identifying educational best practices that supported these standards within the local context. We then reinforced a pedagogy that enhanced and improved teaching and learning using technology tools and resources through performance assessment and financial incentives. This study evaluated and validated a comprehensive, standards-based technology professional development model for teachers that can be customized for each local context.

Theoretical Framework

The integration of technology in classrooms and schools is a complex change process that entails supporting curriculum goals through the instructional use of computer technology to enhance student learning (Dockstader, 1999). Educational change models often attempt to assess and explain the change process in terms of dimensions or degrees of change. Consequently, one way to better understand the difficult instructional issues associated with the integration of computer technology in classrooms is to examine how teachers implement computer technology.

Several models or strategies have been employed by educational researchers and practitioners to provide a systematic approach for determining the quality of innovation implementation. The Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973) emphasizes change as a developmental process experienced by individuals implementing innovations within an organizational context. CBAM has evolved into a comprehensive systemic change model that allows change investigators and facilitators to understand organizational change from the point of view of the persons affected by the change (Surry, 1997).

CBAM is based on the assumption that change is best understood when it is expressed in functional terms—what persons actually do who are involved in the change. Since change involves developmental growth, the focus of facilitation is with individuals, innovations, and the context (Hord, Huling-Austin, & Hall., 1987). CBAM provides for the development of diagnostic tools based on the design of the innovation being evaluated and the operational patterns of those using the innovation.

One such tool that a CBAM investigator may develop and use is the Innovation Configuration Matrix or Map (ICM). The ICM delineates an innovation in the form of a two-dimensional matrix along a scale that renders closer approximations of conceptualized implementation or use along one dimension of the matrix and the various configuration components along the other dimension of the matrix. The ICM has relevance for instructional designers and educational practitioners. Rather than being a static measure, the ICM provides a procedural definition of the specific educational components and features of the innovation within the context in which it is being implemented.

Research questions about educational technology are better formulated when they are concerned with issues of instructional quality and productivity. This study developed and validated an ICM for a school district's technology professional development model based on technology standards and educational best practices associated with these standards. The ICM was used as a tool to analyze the integration of computer technology in classrooms in the school district.

Methods

Instrumentation

An instrument for analysis of technology integration and implementation in classrooms was developed. This instrument, the *Technology Standards Integration Configuration Matrix* (*TSICM*) was based on a consensus-building process that followed a procedure developed by Heck, Steigelbauer, Hall, and Loucks. (1981) and used previously by the researcher (Mills & Ragan, 2000). Relevant national, state, and local technology standards were reviewed and evaluated by the researcher in conjunction with the district technology committee and technology coordinator. The committee agreed upon 18 technology integration standards that were appropriate for the school district. Technology integration standards were organized into three skill sets or phases: Using and Operating Technology in the Classroom (Standards 1-6), Facilitating and Managing Classroom Technology (Standards 7-12), and Technology Integration (Standards 13-18). Each successive phase was intended to identify a set of instructional strategies that exemplified a more appropriate application of technology or a higher quality of technology integration into classroom instruction and learning.

Each technology standard was established as a component of the TSICM and then variations for each component were identified. Variations for each component consisted of discrete categorizations of technology implementation for the corresponding component. Component variations were designed to represent teacher classroom practices along a continuum from unacceptable use to ideal use. The component variations were refined by the technology committee to reflect the actual practices of teachers using computer technology in classrooms. The components and component variations were organized into matrix comprised of four variations for each of the 18 components with each successive variation indicating a level of use representing a closer approximation of ideal or appropriate educational use. The TSICM was deployed as a paper- and web-based checklist.

Data Collection

The school district used in this study was located in a small town in a Midwestern state. The school district had a total enrollment of almost 2,200 students in grades K-12 with 147 certified teachers. Computer technology was used in all the schools in the district. All schools except the high school had computer labs and all teachers had classroom computers.

The school district had made a substantial investment in computer technology and was beginning a district-wide technology professional development initiative. To collect data regarding computer technology implementation occurring among teachers, all teachers at all grade levels were provided with a paper version of the *TSICM* checklist and the option to complete a web-based version of the *TSICM* checklist on the school district web site. The checklist was designed in a multiple-choice format in which respondents could select more than one response for each *TSICM* component.

Data collection occurred at both the start and end of a school year. A usable TSICM was completed by 70 teachers at the start of the school year and 84 teachers at the end of the school year. 57 teachers completed both the start and end of year administration of the *TSICM*.

Data Analysis

The rubric for recording teacher responses on the checklist was to rate to the highest level of use for each component on the checklist. The responses to the *TSICM* checklist were analyzed by cluster analysis to identify relatively homogenous groups of cases based on the *TSICM* components. Discriminant analysis (DA) was then used to assess the adequacy of the groupings from the cluster analysis by using the *TSICM* implementation components as predictor variables. A step-wise methodology was used to enter variables into the discriminant functions. One-way analysis of variance was used to determine if the component attributes of each group were statistically significant. Comparisons were made between the start and end of year data collections using a paired-samples *t*-test. Descriptive statistics for the data collections are provided in Table 1.

Table 1. Descriptive Statistics for Start and End of Year Administration of TSICM.

TECHNOLOGY STANDARD	Start of Year Administration (N=70)			End of Year Administration (N=84)		
	SUM	MEAN	STD. DEV.	SUM	MEAN	STD. DEV.
1. Operate common technology input devices.	217	3.10	.82	313	3.73	.73
2. Perform basic file management tasks.	206	2.94	1.11	316	3.76	.63
3. Apply trouble-shooting strategies and install software.	226	3.23	.87	318	3.79	.70
4. Use software productivity tools.	182	2.60	1.34	297	3.54	1.01
5. Use technology to communicate and collaborate.	228	3.26	.72	316	3.76	.59
6. Use technology to collect data and perform research.	188	2.69	1.10	286	3.40	.95
7. Model responsible use of technology.	174	2.49	1.42	274	3.26	1.13
8. Facilitate regular student use of computer technology.	208	2.97	1.45	257	3.06	1.43
9. Conduct learning activities using computer technology.	187	2.67	1.43	234	2.79	1.46
10. Select appropriate technology resources for classroom use.	83	1.19	1.33	194	2.31	1.69
11. Evaluate the validity of data collected using technology.	22	.31	.91	93	1.11	1.69

12. Use technology to present classroom instruction.	154	2.20	1.16	235	2.80	1.23
13. Integrate technology -based learning experiences into classroom instruction.	138	1.97	1.43	207	2.46	1.48
14. Use computer technology for problem-solving and critical thinking.	118	1.69	1.48	199	2.37	1.48
15. Use technology to facilitate individualized/cooperative learning experiences.	94	1.34	1.39	157	1.87	1.40
16. Assess student use of technology using multiple methods of evaluation.	66	.94	1.57	91	1.08	1.53
17. Develop and maintain electronic student portfolios.	23	.33	.88	48	.57	1.01
18. Use computer technology to maintain and analyze student performance.	136	1.94	1.23	224	2.67	1.08

RESULTS

Since the initial cluster centers and the number of dominant patterns were unknown, cluster analysis was performed on the first administration of the TSICM using all 18 components of the TSICM and incrementing the number of clusters until a reasonable model was obtained. The cluster analysis was run for 2, 3, 4, and 5 clusters before a reasonable model was selected. A reasonable model occurred with the number of clusters set at 3. When the number of clusters was set at 3, the number of cases in Group 1 was 21, Group 2 was 33, and Group 3 was 16. In order to make comparisons between the start and end of year data, this same grouping model (3 clusters/groups) was used for analysis of the end of year data collection.

In order to assess the adequacy of the classification of implementation pattern groups by the cluster analysis a Discriminant Analysis (DA) was performed. The 18 TSICM components were used to separate the groups into the discriminant functions. As a result of this procedure 97% of the cases or 68 of 70 cases were correctly classified. The DA reclassified 1 case in Group 2 for Group 3 and 1 case in Group 3 for Group 2.

The TSICM components were entered into the DA using a stepwise model in order to discard variables that were weakly related to group distinctions. Table 2 identifies the unstandardized discriminant coefficients for each TSICM component that best predicted the discriminant functions for the start of the year administration. Based on the discriminant coefficients, Component 13—Integrate Technology-based Learning Experiences into Classroom Instruction made the most important contribution to Function 1 and Component 8—Facilitate Regular Student Use of Computer Technology made the most important contribution to Function 2. Teachers identified with Group 1 (Technology Operators) were characterized by low or inverse relationships to Functions 1 and 2, Group 2 (Technology Facilitators) by high Function 2, and Group 3 (Technology Integrators) by high Function 1.

Table 2. Canonical Discriminant Function Coefficients.

	Function	
TSICM Component	**1**	**2**
8. Facilitate regular student use of computer technology.	.196	.756
9. Conduct learning activities using computer technology.	.471	.072
10. Select appropriate technology resources for classroom use.	.415	-.496
12. Use technology to present classroom instruction.	.177	-.539
13. Integrate technology -based learning experiences into classroom instruction.	.590	.402
16. Assess student use of technology using multiple methods of evaluation.	.408	-.716
18. Use computer technology to maintain and analyze student performance.	.175	.568

A cluster analysis was performed on the end of year data collection with the number of clusters set at 3 to compare with the clusters from the first of year data collection. With the number of clusters set at 3, the number of cases in Group 1 was 35, Group 2 was 18, and Group 3 was 31. The DA was repeated for the end of year data collection of the *TSCIM* to make comparisons with the first of year data collection. As a result of this procedure 92% of the cases or 77 of 84 cases were correctly classified. The DA reclassified 1 case in Group 1 for Group 2 and 6 cases in Group 3 for Group 1. Table 3 identifies the unstandardized discriminant coefficients for each *TSICM* component that best predict the discriminant functions for the start of the year administration of the *TSICM*. Based on the discriminant coefficients, Component 9—Conduct Learning Activities using Computer Technology made the most important contribution to Function 1 while Component 1—Operate Common Technology Input Devices made the most important contribution to Function 2. Teachers identified with Group 1 (Expert Technology Users/Operators) were characterized by high Function 2, Group 2 (Beginning Technology Users/Operators) by low or inverse relationships to Functions 1 and 2, and Group 3 (Technology Facilitators) by high Function 1.

Table 3. Canonical Discriminant Function Coefficients.

TSICM Component	Function 1	 2
1. Operate common technology input devices.	.317	.764
9. Conduct learning activities using computer technology.	.614	.540
10. Select appropriate technology resources for classroom use.	.409	-.146
11. Evaluate the validity of data collected using technology.	.531	-.774
14. Use computer technology for problem-solving and critical thinking.	.602	.287

Paired samples correlations for each of components of the *TSICM* (technology standards) were computed for matched cases on the start and end of year administrations of the *TSICM*. (see Table 4). Almost all components of the *TSICM* indicated significant differences on the *t*-test (p<.05) between the start and end of year administrations. Additionally, paired samples correlations were computed when *TSICM* components were grouped by skill set or phase (see Table 5) and significant differences on the *t*-test (p<.05) were indicated for all three phases.

Conclusions

An interesting conclusion we deduced from the start of year data collection for this population of teachers was that proficiency in the use and operations of computer technology (Phase 1) was not necessarily a distinguishing attribute of high quality technology integration. Differences among the groups in this study at the beginning of the school year were delineated more by attributes of technology integration than by technology use and operations. This finding had relevance for the provision of technology professional development activities. These results clearly demonstrated that technology training activities for this school district needed to focus more on instructional strategies and methods to integrate technology in the classroom than on training activities to increase skills in the operation of computer hardware and use of software applications.

Table 4. Paired Samples Correlations by Technology Standard for Start and End of Year Administrations of TSICM (N=57).

TSICM Component (Technology Standard)	Correlation	*t*
1. Operate common technology input devices.	.273	-4.375*
2. Perform basic file management tasks.	.190	-4.169*
3. Apply trouble-shooting strategies and install software.	.330	-4.119*
4. Use software productivity tools.	.260	-5.314*
5. Use technology to communicate and collaborate.	.094	-2.950*
6. Use technology to collect data and perform research.	.002	-2.713*
7. Model responsible use of technology.	.419	-4.158*
8. Facilitate regular student use of computer technology.	.659	-.882
9. Conduct learning activities using computer technology.	.696	-1.135
10. Select appropriate technology resources for classroom use.	.374	-4.820*
11. Evaluate the validity of data collected using technology.	.373	-3.853*
12. Use technology to present classroom instruction.	.379	-3.340*
13. Integrate technology-based learning experiences in classroom instruction.	.586	-3.040*
14. Use computer technology for problem-solving and critical thinking.	.596	-4.428*
15. Use technology to facilitate individualized/cooperative learning experiences.	.485	-2.573*
16. Assess student use of technology using multiple methods of evaluation.	.474	-.338
17. Develop and maintain electronic student portfolios.	.581	-2.379*
18. Use computer technology to maintain and analyze student performance.	.320	-2.982*
Total Score All Standards	.708	-7.447*

*Significant at .05 level for two-tailed test

Table 5. Paired Samples Correlations by Type or Technology Standard for Start and End of Year Administrations of TSICM (N=57).

Skill Set/Phase of Technology Integration	Correlation	*t*
Using and Operating Technology in the Classroom	.441	-6.777*
Facilitating and Managing Classroom Technology	.746	-6.141*
Integrating Classroom Technology	.638	-4.058*

*Significant at .05 level for two-tailed test

By the end of the school year, the characteristics that delineated differences among the teachers in technology integration was more sharply defined by teachers who were beginning or expert operators of computer technology and those who were facilitators and managers of classroom technology. Thus, there was a clear progression among the teachers from technology operations to technology facilitation. While the technology professional development program at the school did not make technology integrators out of all participants, it clearly accommodated reasonable growth and advancement in the technology integration skills of the participants. When we considered only those teachers for whom we had both start and end of year data, a significant pattern of growth across standards and at all skill levels was indicated. This observation suggests that when educational best practices for teaching and learning with technology are clearly defined and established, the professional skills of teachers will begin to exemplify the stated expectations.

We have learned from this study that classroom technology integration was not so much about the quantity of teacher interactions with technology, but rather it was about the quality of teacher interactions with technology. When teacher interactions with technology were accompanied by expert teaching practices and related to curriculum objectives, the quality of technology integration was increased. Over time we have refined our technology integration professional development model to include more powerful technology integration strategies in classrooms beyond that of computer technology use and operations. We have learned that through the establishment of a well-defined set of pedagogical standards and indicators, higher levels of technology integration in classrooms can be identified and achieved. Consequently, when teachers know how to use and then actually use all the tools at their disposal, classroom pedagogy is expanded and improved.

Although many school districts have established benchmarks or standards for the integration of technology in classrooms, no model or methodology exists for substantiating technology standards with actual classroom practices. The *TSICM* represents a flexible and adaptable approach to the evaluation of technology integration in classrooms because the *TSICM* components reflect a set of widely-used standards that can be contextualized.

A methodology to provide comprehensive and continuous analysis of technology implementation is needed to sustain high levels of use and integration of computer technology in classrooms. This study demonstrated that the *TSICM* is an effective tool to determine technology integration in classrooms, to reveal the technology integration characteristics of teachers integrating technology in classrooms, and to distinguish appropriate technology training themes that focus on specific technology standards.

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Critical Examination of the Use of Online Technologies in Diverse Courses at a Large Comprehensive University

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Abstract

We explore cases of three classes that implemented online teaching / learning technologies as part of a university wide faculty development grant program. We examined students' satisfaction with key components of the learning experience. Instruments included students' pre-assessments and post assessments, an instructors' post survey, course syllabi, grant proposals, and instructors' end of grant reports. We present implications for campus wide implementation of online teaching/ learning technologies. We include discussion of a model for implementing innovative technologies campus wide (online teaching support model).

Background

In 1997, faculty interest in online teaching at California State University San Bernardino (CSUSB) started increasing. By 1999, the number of faculty who wanted to do online teaching had grown significantly. Faculty faced many questions and issues as they embarked to do online teaching. The Teaching Resource Center (TRC), the faculty development unit that support teaching and innovative instruction, also faced the task of helping in faculty's new role as online teachers.

To address these needs, TRC drew upon instructional design and evaluation models (Van Slyke, Kittner & Belanger, 1998; Belanger & Jordan, 2000; Dick & Carey, 1996; Salisbury, 1996; Seels & Glasgow, 1998) and identified the major steps involved in course development as applied to online teaching. TRC developed a systematic and holistic plan that serves both as the map and the glue that holds the various phases and players together (Santiago, 2001). This systematic plan has 7 major steps:

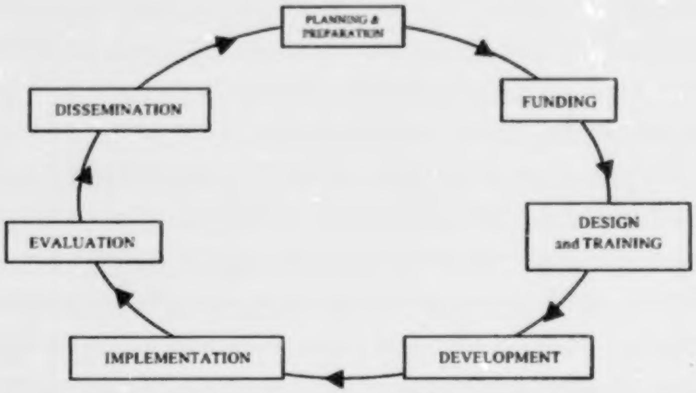

Figure 1. Online Teaching Support Model: 7 Major Steps

Planning and Preparation. The instructor studies the big picture and the instructional and non-instructional issues that will have an impact on successful online teaching. Addressing issues up front gives a good estimate of how much time and effort need to be invested, and helps determine one's readiness for online teaching.

Funding. Faculty are encouraged to seek funding through grant programs that lead to a course buyout, money for resources and/or hire a student assistant

Instructional Design and Training: Designing lessons for online teaching is not simply converting existing materials into digitized format. Skills and training for goal analysis, task analysis, assessment, instructional materials development, and the use of hardware and software are addressed in this step.

Instructional Materials Development and Testing. This step involves developing instructional materials, testing them, and making sure that they can be delivered successfully online, and that users will be able to access them with minimal, if not totally free of instructional and technological glitches.

Implementation. The course is actually taught online. The instructional design is put into action, the instructional materials are used, and technology is relied upon to deliver instruction, all towards the achievement of learning goals.

Evaluation. Evaluation identifies the strengths and weaknesses of the instructional design, of instructional materials, and delivery medium. Most importantly, it measures the extent to which goals were met.

Dissemination. Innovation and change that is well planned and appropriately evaluated also results in lessons learned and quality products. When reported to a professional community, this leads to further validation, peer evaluation, and replication, which then leads to scholarship of teaching (Hutchings and Schulman, 1999).

Description of Grant Program

To support online teaching, TRC sponsors the Web-based Course Development Grant program that awards summer stipend ($5,000) to faculty. The course redesign or development could range from using a significant combination of online features as teaching enhancement, or to deliver the whole course online. When first offered in 1999, 12 faculty proposals were funded. The Course Development Grant Program was funded by the Office of the Provost. Administrative support for online teaching also resulted in student support through the Student Technology Support Center, the establishment of an Office for Distributed Learning and the hiring of a librarian to support distance courses.

Analysis of the Efficacy of the Grant Program

To inform our analysis of the efficacy of the online components of the courses, we utilized a variety of assessment tools including pre and post surveys of students, a post survey of faculty, and an analysis of course syllabi, grant proposals and final reports.

Comparison data from the three classes in which we had sufficient data from both the student pretest and posttest are listed below. We report results from a comparison of the uses of online technologies in the three courses. We examined student data (pretest and posttest), faculty data (free response and multiple choice questions), course syllabi, and the course development proposal. Our intention was to utilize triangulation in an attempt to ascertain factors that led to successful and efficacious uses of online technologies from both the faculty and the student perspectives.

Three classes that were offered in the 1999-2000 academic year were examined. The description of each course is listed as it appeared in the course syllabi and/or the catalog of programs:

1. English as a Second Language (EESL) – Research in English as a Second Language: Covers various perspectives used to guide research in TESOL. Includes analysis, discussion, reflection and writing about key issues and concepts in research. Students will design and carry out literature review working towards a theoretical framework to gain foundation as expert practitioner or future researcher.
2. Criminal Justice (CJUS) – Research Methods in Criminal Justice: Introduction to scientific methodology and research designs used to conduct basic and applied research in the criminal justice field. Emphasis on scientific operationalization, survey methodology, and concepts of evaluation design.
3. Information Sciences (INFO) – Decision Support Systems: Formal information systems that support organizational decision-making. Topics include the strategy, framework, design, implementation and evaluation of decision support systems. Students will create and apply decision support systems to planning, coordinating, organizing, controlling and/or directing tasks.

Pre-Survey

In the student pre survey, we obtained data on three categories: student demographics, student background, and student experience on the use of technology. A summary of demographic data for 61 students who took the pretest in the 3 classes is listed below.

Table 1. Student Demographics

Demographics		CJUS	EESL	INFO
Level	Graduate	3%	91%	5%
	Senior	40%		90%
	Junior	47%		5%
Degree sought	Masters	10%	100%	15%
	Bachelors	90%		75%
Age	40's & 50's		27%	20%
	30's	7%	45%	15%
	20's	87%	27%	65%
Gender	Male	43%	18%	45%
	Female	53%	82%	55%
Miles from campus	> 50 mi.	10%	18%	5%
	40-49 mi.	3%	9%	10%
	30-39 mi.	17%	0%	20%
	20-29 mi.	17%	9%	5%
	10-19 mi.	20%	0%	15%
	< 9 mi.	27%	55%	40%

Table 2. Student Background

Background		CJSU	EESL	INFO
Reason for taking course	Recommended	27%	9%	25%
	Required	83%	100%	70%
	Interesting	17%	18%	30%
	Fits schedule	37%	18%	60%
Hours to spend on course	>= 17 hrs	3%	36%	0%
	13-16 hrs	3%	9%	0%
	9-12 hrs	23%	36%	10%
	5-8 hrs	57%	18%	75%
	0-4 hrs	13%	0%	15%
Same instructor before	Yes	37%	73%	10%

As shown above, the majority of the students were in upper division working for a bachelor's degree except for the Education masters students (EESL). Most of the students were in their 20's and 30's. Female students were in the majority, especially in the Education course. Almost half of the students live close to campus (< 9 miles) except for the CJUS students who are distributed in various distances from campus.

For background data, we surveyed students' reasons for taking the course, the number of hours that they intended to spend on the course per week, and whether they have had the instructor before. Data from this component of the survey is listed below.

In general, students were taking the course because it was required. A secondary reason was that it fits their schedule. The majority of the undergraduate students planned to spend 5-12 hours per week on the course, with graduate students planning to spend more than 17 hours per week on their course. Most of these graduate students have had a course with the instructor before.

We also surveyed students' use of and comfort level with online technologies. A summary of students' use of technology is given below:

Table 3. Student Use of Technology

Use of technology		CJUS	EESL	INFO
Access at home	Computer	93%	91%	100%
	Internet	87%	91%	90%
Used in previous course	Online syllabus	47%	73%	40%
	Online Lectures	33%	73%	30%
	Online Tests	7%	82%	20%
	Online Research	70%	91%	80%
	Online Discussion	10%	36%	20%
	Email	77%	91%	80%
	Chat Rooms	23%	9%	25%
Comfort level (5=highest)	Using computers	4.3	4.0	4.8
	Using internet	4.3	3.9	4.7
	Using Chat Rooms	3.2	3.4	4.1
	Using Email	4.1	4.6	4.6
	Taking Online Course	3.2	3.8	3.6
	Joining Online Discussion	2.8	3.5	3.7

Based on the data, student access to computers and Internet at home is very high (87-100%). Of the three groups, the graduate students had the most experience in the use of online technology in a course. Online experience is high for research and email use in all three courses. Students are most comfortable in the use of computers, Internet and email.

Post-Survey

In the student post survey we coupled the internally developed and tested Student Evaluation of Learning Effectiveness (or SELE, a self report measure of learning that utilized a 5 point Likert scale and which had been approved for use in evaluation of teaching by the Faculty Senate), with a self-report instrument concerning technology use in the course.

One particularly striking result involves the post survey item concerning how well the online learning experiences fostered interaction and teamwork among class members. In INFO, this was unmistakably the most highly rated item (mean = 4.5 of 5). In the other two courses, EESL and CJUS, this was clearly the lowest rated item (mean = 3.1 of 5, mean = 2.9 of 5, respectively). In comparing scores of both EESL and CJUS with INFO, two tailed t-tests indicated significance with $p<.01$.

Table 4. Online Components of Course Fostered Interaction and Teamwork

		CJUS	EESL	INFO
Course fostered interaction and teamwork	5=Excellent	29%	18%	59%
	4=Very Good	0%	9%	35%
	3=Satisfactory	21%	45%	6%
	2=Poor	29%	18%	0%
	1=N/A	21%	9%	0%
	Mean	2.9	3.1	4.5

We found the highest mean posttest scores in the answers to three questions that related to the structure of the courses and to the involvement of the teacher in the learning process.

Table 5. Satisfaction With Course Items Controlled by Instructor

		CJUS	EESL	INFO
Matched objectives with assessment	5 = Excellent	50%	27%	41%
	4 = Very Good	36%	36%	47%
	3 = Satisfactory	7%	36%	12%
	2 = Poor	0%	0%	0%
	1 = N/A	7%	0%	0%
	Mean	4.2	3.9	4.3
Utilized clear grading criteria	5 = Excellent	43%	55%	47%
	4 = Very Good	36%	0%	41%
	3 = Satisfactory	14%	27%	12%
	2 = Poor	0%	18%	0%
	1 = N/A	7%	0%	0%
	Mean	4.1	3.9	4.4
Instructor contributed to learning	5 = Excellent	43%	36%	35%
	4 = Very Good	50%	36%	53%
	3 = Satisfactory	0%	27%	12%
	2 = Poor	0%	0%	0%
	1 = N/A	7%	0%	0%
	Mean	4.2	4.1	4.2

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Table 6. Did Online Components Foster Discussion on Multicultural and Diversity Issues?

Fostered discussion on multicultural and diversity issues

	CJUS	EESL	INFO
5 = Excellent	29%	27%	18%
4 = Very Good	14%	18%	35%
3 = Satisfactory	21%	36%	29%
2 = Poor	14%	18%	18%
1 = N/A	21%	0%	0%

To the question: "The course matched objectives with assessment", the mean for CJUS was 4.2, for EESL, it was 3.9, and for INFO, it was 4.3. "Utilizing clear grading criteria was also rated high by all three courses, with INFO mean at 4.4, CJUS at 4.1 and EESL at 3.9. All three courses had almost the same means for the question "Instructor contributed to learning" (CJUS = 4.2, EESL = 4.1, INFO = 4.2). In tandem, this data would be an indicator of clear grading criteria that connected with stated objectives of the courses.

The lowest means reflected responses to whether the online components of the course "Fostered discussion on multicultural and diversity issues".

When it came to identifying who contributed to the learning experience, the instructor was ranked highest, based on the mean scores. EESL ranked "self" equally with the instructor, while CJUS ranked "self" as second and other students as lowest. Interestingly, concerning who contributed to their learning, INFO ranked "Other student/s" equally with the instructor. For both CJUS and EESL this was the lowest rated item of the three.

Table 7. Rating For How Well the Instructor, the Student, and Other Students Contributed to the Learning Experience

Contributed to learning experience	CJUS	EESL	INFO
Instructor	4.2	4.1	4.2
Self	3.6	4.0	4.0
Other Student/s	3.4	3.5	4.2

We also surveyed how satisfied students were with online course materials. Satisfaction was rated high by all three courses. However, when asked if on line materials helped facilitate learning, means for all three courses were low.

Table 8. Online materials survey results

	CJUS	EESL	INFO
Satisfied with online materials	4.7	4.1	4.2
Online materials facilitated learning	2.3	3.4	3.5

For all 3 courses examined, online materials were reported to have saved students time. However, in the EESL class, students reported spending more time on the online tests but saving time through use of discussion board.

Table 9: Time Spent/Saved Using Online Components

Time Spent

		CJUS	EESL	INFO
Online Materials				
	Saved time	36%	64%	69%
	Spent more time	0%	9%	6%
	No answer	64%	27%	13%
Online Tests				
	Saved time	0%	27%	0%
	Spent more time	0%	55%	0%
	No answer	100%	27%	100%
Discussion Board				
	Saved time	7%	64%	0%
	Spent more time	0%	9%	0%
	No answer	93%	27%	100%

Faculty Syllabi, Proposals, Grant Reports, and Post Surveys

The faculty post survey was composed of items concerning their needs and uses of online technologies, coupled with an evaluation of students' learning that paralleled the student post survey. We also examined how the use of online technologies impacted faculty workload.

In our ongoing analysis we are considering the factors that led to successful and efficacious use of online technologies for both faculty and students. We are currently conducting our analysis via triangulation where we compare student data, faculty data (composed of free response and multiple choice questions), information provided in the course syllabi, the grant proposals, and the end of grant reports.

We were not able to directly correlate the faculty post data with the student post data for individual courses due to the anonymity of the faculty post surveys. However, we were able to glean some data in the aggregate for professors' general satisfaction with the use of online technologies in their classes. Based on that data it was clear that faculty appreciated the support that was given to them.

Two of the three instructors provided access to syllabus information. Based on this information, in the INFO class, students were required to work in teams to complete projects. The professor used online materials but did not list use of the discussion board in his syllabus. By contrast, in the EESL class, students were not required to work in teams. The instructor required the use of the discussion board, online materials and online tests.

Table 10: Online components of Course Design

COURSE DESIGN	Based on Proposal:			Based on syllabus:			Based on final report:		
	CJUS	EESL615 EESL	INFO	CJUS	EESL	INFO	CJUS	EESL	INFO
Online Materials	All course notes, exercises	Information modules/ tutorials using PowerPoint and audio	Course content, glossary, site links for articles		Assignment descriptions			Course materials	Course content
Online Tests	Practice quizzes, assessment	Part of tutorial	Online quizzes and surveys		100-point quiz set, review quizzes			Quizzes	
Online Research					Accessing TESOL research via technology				

Online Discussion				
Email				
Chat Rooms	Mentioned in the justification but not part of project description			Mentioned it affords students to interact but was not reported to have been done
Bulletin board		Weekly announcements	Used extensively	

In the grant proposals, teaching was to be enhanced with the posting of online materials and links to relevant websites (see figure 10). EESL also incorporated the use of online tests and discussion board. INFO proposed to implement more technologies than were actually incorporated into the course.

Discussion

Based on the data presented above, it appears clear that in all three courses, students were satisfied with the connections made between the objectives of the course and the assessments used. This would imply that the courses were relatively well designed.

However, though the courses were relatively well received, it appears that improvements could have been made in the effective use of online technologies. For instance, the INFO course did not, according to the syllabus, the final report and the students' post surveys, use a discussion board for collaboration and file sharing. This was the case even though extensive collaboration was necessary for successful completion of course projects and even though at least 40% of the students lived 20 or more miles from campus.

Myer (2001) indicated that a fundamental problem with much research on online instruction is that it has failed to disaggregate the effects of the instructional design from the effects attributable to the technology. This appears to be the case in the courses that we examined above, as each could be shown to have been efficacious (based on student post survey data).

It is striking that two of the three courses did not reflect good scores on online learning activities fostering interaction and teamwork. This is striking as online technologies such as threaded discussion boards and chat rooms can be very powerful tools for collaboration (see Jonassen, et al., 1999). This would suggest that the full power of the technologies available through the WebCT tools to the instructors had not been utilized. In the third course, the INFO course, it is not clear whether chat rooms were utilized by students (see table 10). However, the structure of the course required extensive collaboration on projects (according to the course syllabus).

Similarly, for all three classes, the mean scores on facilitating discussions concerning diversity were low. Online technologies have the potential to enable ready access to global perspectives (see Papert, 1998), yet it would appear that this characteristic of the technology was not utilized effectively.

The fact that students in all three classes generally believed that using online technologies saved time would suggest improved instructional efficiency for all classes. With a population composed of commuters, who often hold full time jobs, this result is weighty.

Though we asked students to rate how well the online learning experiences (using 5=excellent; 4=very good; 3=satisfactory; 2=poor; 1=not applicable), contributed to the effectiveness of the class (as measured by multiple items detailed in the above tables of results), respondents may not have read the items with respect to online technologies but rather with respect to the entire class. For instance, in the INFO class, students identified online components of the class to have contributed to fostering interaction and teamwork, yet a discussion board was not utilized in the course, according to the proposal, the syllabus, the final report, and student post surveys. We are also concerned that in some cases, students may not have understood the terms used and may have therefore answered questions erroneously (e.g. some students rated discussion boards and chat rooms that did not appear to have been implemented in a particular course).

Given our data analysis, several implications are suggested for implementation of the Online Teaching Support Model at our university. In examining the 7 components of the model, there is evidence that several of the components may require substantial additional support. Specifically, the instructional design and training area may need additional attention to enable faculty to best integrate online technologies into their course design. We are concerned that our evidence suggests that instructors may not use the most powerful or appropriate technologies to assist with learning outcomes for their class or that they may use technologies in ways that are not effective. Additionally, in the evaluation area, several flaws were present. Faculty did not administer the instruments consistently in their courses (even though evaluation was a critical component of the grant). Thus, of the twelve funded projects, we were able to realize comparison data from only three classes in which we had sufficient data from both the student pretest and posttest.

We surmise that, in general, there is a tendency for faculty to focus on innovation and on technology and not on evaluation of the online course components. In order to better collect data from faculty, and to encourage them to have students participate fully in pretest and posttest administration, additional faculty incentives and reminders are likely to be necessary. Engaging faculty in a post-course interview would also likely assist analysis of the efficacy of the online course components.

We will apply the lessons learned from this analysis to future faculty development grant projects. This will assist us in serving the educational needs of our students through the use of technologies that can bridge barriers to access. We believe that the Online Teaching Support Model can be effectively applied at other institutions that would internally fund faculty development efforts. Based on our experience, special attention should be applied to the instructional design and evaluative components of such efforts.

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Online Collaborative Documents for Research and Coursework

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Abstract

Online collaborative documents can be used effectively for conducting collaborative research and for learning collaboratively via the Internet. Collaborative documents are dedicated online workspaces that allow individuals or groups to use the Internet to share their work with others, edit it, and finalize it. This paper identifies Basic Support for Cooperative Work and FirstClass as Internet tools that have enabled collaboration across distance for both research and coursework, and it provides real-life applications of those tools in higher education.

Introduction

We use online collaborative documents for conducting collaborative research and for learning collaboratively via the Internet. The increased use of the Internet in higher education has allowed researchers to conduct collaborative research and faculty to provide opportunities for students to work collaboratively in their courses. Collaborative documents are dedicated online workspaces that allow individuals or groups to use the Internet to share their work with others, edit it, and finalize it. Real-time chats, computer conferences, and email may be used to support collaborative documents but are not collaborative documents according to our definition because they are not dedicated workspaces.

Collaborative learningis an instructional method in which small groups of learners work together to accomplish shared goals (Slavin, 1994). Similarly, computer-supported collaborative work allows working groups distributed in time and space to use groupware. Various Internet tools have enabled collaboration across distance for both research and coursework.

Collaborative Documents for Research

Since the advent of email, and fax, researchers across distances have used telecommunications to write documents together—getting feedback from co-researchers and incorporating those ideas into the manuscript. Eventually, through multiple- iterations, the document becomes a final product. The early Internet researchers had to think creatively so that their co-collaborators could discern the changes made to the document. For example, in 1991 two researchers co-authored a book chapter using boldface type, square brackets, and initials and dates via email between their two universities (Murphy & Rogers, 1993).

Electronic bulletin board systems and computer conferencing software such as Wildcat, VAXNotes, LotusNotes, and Web boards allow users to hold asynchronous, threaded discussions online. Through such server software, co-researchers can share their ideas in an organized manner without using their own disk space. Most of the early software programs did not allow attachments. More recently, we have used several Web tools with shared workspaces for conducting our research: Basic Support for Cooperative Work (BSCW) because of its capabilities for file attachments and version control; and FirstClass computer conference software because of its asynchronous and synchronous communication, file transfer, and collaborative document functions. See Table 1 for shared characteristics and Table 2 for differences between BSCW and FirstClass.

Table 1. Shared Characteristics of BSCW and FirstClass

Server-based
Individual and collaborative workspaces
Text-based
Asynchronous threaded discussions
File attachments
Links to Internet
Cross-platform

Table 2. Differences between BSCW and FirstClass

BSCW	FirstClass
Free	Requires a license
Web accessible	Web and client accessible
Icon and menu driven	Graphic user interface
No synchronous chat capability	Synchronous chat capability
Automatic version control	Manual version control
Steep learning curve	Short learning curve
Complex organization	Simple organization
Meeting notification	Special forms

BSCW description and research examples

The process of file attachments and version control in BSCW is relatively simple. Researcher 1 first attaches a file in a workspace and then establishes version control on the file. Researcher 2 then downloads the file, uses typical editing functions (e.g., colored font, boldface type, comments in brackets, dates), saves it, and uploads it to the dedicated workspace. All versions of a document are maintained in the workspace without being over-written. Although the researchers do not rename the file as they upload it, the BSCW software automatically assigns the new file with a new version number and names the author of that version. When multiple collaborators create a document, this process of version control keeps track of multiple iterations. The primary disadvantages of using BSCW are its steep learning curve and a slow rate of speed in updating Web pages due to the extensive graphics on the BSCW Web site.

Researchers have used BSCW for shared research in co-authoring papers and manuscripts between two countries or cities. For example, prior to working on manuscripts when one would be in Taiwan and the other in the U.S., the second and third authors met face-to-face to establish the method of exchange and encountered the following problems only after one researcher traveled to Taiwan: (a) figures created on one platform did not always show up on another; (b) communication was interrupted when an undersea cable linking the United States and Taiwan was damaged; and (c) communication was delayed when Internet traffic was jammed in Taiwan. This Internet traffic worsened when students were out of school during vacations. Fortunately, the telecommunications company arranged for the net users to transmit data through a backup cable as well as a satellite-based network (Cifuentes & Shih, 2001; Hsu, 1999; Staff Reporter, The China Post, 2001). Similarly, the first author met face-to-face twice with two co-authors to brainstorm the method and later to analyze data, and they accomplished the remainder of the research using BSCW's version control to communicate between two cities in Texas (Murphy, Mahoney, & Harvell, 2000).

A second example of how researchers use BSCW for shared research is in guiding dissertation research. The first author designates a shared workspace for each of her doctoral students in her own workspace. The students are each responsible for posting drafts and final versions of their work in their workspaces for the dissertation chair to read, edit, comment, and guide the process. A typical doctoral student's BSCW workspace includes the following folders: Bibliographies, Discussions, Meeting Notes, Prelims and Orals, Proposal Components, Dissertation Components, and Resources. The researcher finds BSCW a convenient and powerful tool to track the progress of her doctoral advisees as well as share resources among the students.

FirstClass description and research examples

Researchers suggest that the very nature of computer conferencing—its capacity to support interaction among students—fosters a collaborative approach to learning (Harasim, Hiltz, Teles, & Turoff, 1995). FirstClass computer conference software provides multiple functions that foster collaborative research and learning: threaded discussions in icon-based conferences, file attachments, private email, real-time text-based chats (Persico & Manca, 2000), and collaborative document writing spaces. The text-based collaborative document writing spaces allow only one person to edit a document at a time, using word processing capabilities like font types, colors, and sizes. However, multiple readers can access these continuous unbroken documents simultaneously. Currently, the client version of FirstClass must be used in order to open and write in collaborative documents, as the Web version does not provide that capability.

The first author and several local doctoral students used FirstClass collaborative documents to prepare two conference papers (Murphy, Harvell, Epps et al., 1999; Murphy, Harvell, Sanders, & Epps, 1999). The shared workspaces provided the authors with "boundaries around a protected space, with the members of the group sharing a common experience" (Palloff & Pratt, 1999, p. 61). In both cases, the researcher was careful to save the collaborative documents to her hard drive daily, because such documents cannot be protected and still allow multiple users to access the document.

Collaborative documents for coursework

With the advent of the Web for course support or delivery, designing authentic and relevant activities that foster collaboration among learners has become a challenge for instructors and course designers (Carr-Chellman & Duchastel, 2000; Cifuentes, Murphy, Segur, & Kodali, 1997). Collaborative workspaces and documents facilitate a variety of learning activities in Web-based courses including tutorials (Cifuentes & Shih, 2001; Cifuentes & Shih, in press; Davis & Chang, 1994/95; Kamhi-Stein, 1997; Leh, 1997), small-group discussions, project-based work, collaborative problem-solving activities (Romiszowski, 1997), brainstorming (Kay, 1995; Neuhaus, 1997; Siau, 1995, 1996), and case-based learning (Ertmer & Quinn, 1998). In collaborative workspaces and documents in BSCW and FirstClass, learners can identify their contributions by dating and signing them and by using different colors. Because a FirstClass collaborative document is a continuous unbroken document that allows users to "get a holistic view of the activity without having to open and close numerous messages" (Murphy & Gazi, in press), learners find the tool easy to use for brainstorming and planning activities as well as for editing each other's work. In the following sections, we illustrate applications from our coursework of each of the preceding learning activities.

Tutorial

American and Taiwanese university students corresponded via e-mail and a Web-board to prepare U.S. preservice teachers for online teaching and reaching diverse learners, and to provide English instruction to the Taiwanese students. U.S. preservice teachers explored theory and practice of online instruction, corresponded as tutors to teach English language and American culture, and reflected upon their experiences. Taiwanese students practiced English and exchanged cultural information. Throughout the correspondence, the two parties made use of different strategies to achieve their predefined instructional and learning goals. The preservice teachers employed a total of seven online teaching strategies: (a) facilitative information, (b) questions and answers from tutor to student, (c) questions and answers from student to tutor, (d) topic discussion, (e) problem solving, (f) critique of writing, and (g) recommendations for metacognition. Similarly, the Taiwanese learners used ten online learning strategies: (a) responsive dialogue, (b) translation, (c) responding to tutors' questions, (d) asking questions of tutors, (e) explanation, (f) elaboration, (g) decision-making, (h) self-reflection, (i) metacognitive strategies, and (j) transfer (Cifuentes & Shih, 2001; Cifuentes & Shih, in press).

Small-group discussions

All online classes in our educational technology program, and most classes that are not online, include online discussion spaces. Students discuss course readings and learn how to moderate discussions on specific topics.

Project-based work

In an introductory instructional design course, students used FirstClass to conduct project-based work in small groups. Students work with a client and often with an online team to carry out the phases of instructional design. For instance, two students living in cities separated by hundreds of miles designed and developed teacher training on thematic-unit design for a school district. They shared design and development processes using a dedicated space in FirstClass. They established goals; designed instruments for analyses of the learners, context and goals; wrote objectives and developed assessment instruments, shared evaluation data, and assigned development tasks to each other in FirstClass.

Students in introductory distance learning courses at two universities used the FirstClass server at one of the universities to design, develop, and evaluate telecommunications-based case studies in small teams. Most teams scheduled regular online chats with their team members as well as working asynchronously in threaded discussions to collaborate on the project. Each group developed its own evaluation criteria, which the other groups used to evaluate its products.

In other courses students collaboratively produced instructional thematic units, Web pages, and computer graphics using FirstClass. In a class that focused on design and development of student-centered, technology rich thematic units (Roberts & Kellough, 2000), students teamed to develop those units. They brainstormed to agree on a theme for their team's unit and submitted contributions to the unit in the shared workspace. Contributions included readings of interest, PowerPoint presentations, WebQuests, ideas for telecommunications partnerships, and lesson plans.

Students also collaboratively created computer graphics by submitting those graphics to a team in a dedicated space in FirstClass. Team members could alter the PowerPoint presentations, PhotoShop files, and Director files and resubmit them with their embedded feedback and changes. In this way students were able to receive concrete feedback from both the instructor and fellow students in order to learn principles of effective design.

Collaborative problem-solving activities

For a survey course in educational technology, the instructor posed a simulated problem for students to address in FirstClass collaborative documents and threaded discussions. The instructor invented Mythica, a mythical oil-producing country comprised of 18 islands and inhabited by people accustomed to learning by rote memorization. The students' challenges were to answer questions related to the simulation and to submit a bid on a project for teaching English to the entire Mythica population. Three co-facilitators presented the simulation to two teams of their classmates, who responded to the questions in their collaborative workspaces. The teams competed for the winning bid by helping their teammates with refinements of their replies (Murphy, Moran, & Weems, 2000).

In a course about distance learning, students used FirstClass to complete training modules on Internet tools in dyads: a trainer and a trainee. The trainer first developed a training program for a specific tool, such as CU-SeeMe, and then delivered the training to the trainee via FirstClass as a pilot test. The trainee was responsible for giving feedback to the trainer regarding accuracy and clarity. After the trainer made the necessary revisions and the trainee approved them, the student Webmaster published the training programs on the Web for other students to access and use. In the final step of this process, the trainer and trainee individually recorded their reflections about the experience (Murphy, Harvell, Sanders, & Epps, 1999). In most cases, the more experienced Internet user was the trainer; however, some dyads reversed their roles so that the inexperienced user would gain more expertise.

Brainstorming

Students in a Computer Graphics for Learning course used a dedicated space in FirstClass to brainstorm ideas prior to creating instructional animations. The assignment was for each student to develop an animation that would help learners understand a complex concept. In previous semesters several students had submitted animations that were primarily cosmetic rather than instructive. In an attempt to hinder such submissions, the instructor set up a brainstorming conference in FirstClass. In that conference, students were requested to enter their ideas for instructive animations and they were allowed to give each other feedback regarding the value and attributes of such an animation. One student's idea led to many students' ideas, and ultimately all students formulated good ideas for meaningful animations.

Case-based learning

In an introductory instructional design course, students analyzed cases following recommendations for case analysis (Ertmer & Quinn, 1998). They negotiated meaning regarding the nature of the problems posed and potential solutions using FirstClass. Students discussed 24 ID cases according to key issues of the cases, key players' perspectives, potential solutions related to problems, and recommendations for action.

Conclusions

Garrison's (2000) review of distance education theories describes the current need for "sustained real two-way communication" (p. 13) to be at the core of the educational experience. Until recently, the field was dominated by organizational (structural) assumptions. However, with the advent of new methods and technologies, the field will "demand theories that reflect a collaborative approach to distance education…and have at their core an adaptive teaching and learning transaction" (p. 13). One way to apply such theories to research and coursework is to use collaborative documents to promote transaction culminating in deliberation among the key players. Such deliberation can create "a particular kind of democratic public culture among the deliberators: listening as well as talking, sharing resources, forging decisions together rather than only advocating positions taken earlier, and coming to disagreement" (Parker, Ninomiya, & Cogan, 1999, p. 129).

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Building Team Collaboration in the Virtual Classroom

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Abstract

The benefits of collaboration and team skills have long been recognized in both business and academic settings. In a study involving a team of business professionals performed in 1967, Maier concluded that teams have a distinct advantage over individuals in that they have a greater pool of knowledge, receive more input and solutions to problems, and encourage a better collective acceptance and understanding of group decisions. A more recent study of student teams concluded that team projects develop individual collaborative skills, strengthen both individual and group commitment to teamwork and prepare students for the 21st century workplace (Rooney, 2000).

In online collaborative learning situations, however, research suggests that team assignments can often frustrate and annoy students (Bowen, 1998). Teams must deal with new expectations, attitudes, boundaries, and responsibilities which can all cause clashes (Joinson, 1999). Further, since the tendency of online learners leans toward self-direction, students have a natural resistance to team projects where outcomes rely upon the input of others (Ko & Rossen, 2001).

Two investigators developed a web-based teambuilding instructional and activities module to improve the collaboration skills of team members involved in online collaboration. This module was formatively evaluated using 24 graduate students who were enrolled in an online course that assigned two online team projects during the Fall 2000 semester. The objectives of the investigation were: 1) to explore whether or not online learners valued the VTB instruction they received as preparation for online team projects, 2) to explore how online learners who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team, 3) to determine the online collaboration skills online learners gained after they had completed the module, and 4) to determine whether learners believed that they would use the online teamwork skills and knowledge they gained from the instructional module in future online collaborative teams.

Both quantitative and qualitative data indicated that students were satisfied with the teambuilding instruction and their virtual team experiences, gained online collaboration skills and indicated they would apply these skills to future online collaborative projects. These findings imply that educators who teach online graduate courses and assign online team projects should consider integrating online teambuilding instruction into their coursework and study the value of this instructional approach for their students.

Statement of the Problem

With the advancement of technology, online instruction that often involves team projects is becoming more prevalent (DeNigris & Witchel, 2000). As this trend is still fairly recent, there are major discrepancies between the available resources to increase the effectiveness of instructors who teach online and the resources available to instructors who teach face-to-face. Hara and Kling (2000) found that the quality, quantity, and accessibility of materials available to online teachers are inadequate.

Although there has been an increase in the frequency of educational teams, it has not been matched with adequate teacher training in collaborative group processes to promote team potential, team productivity, and team maintenance (Trimble & Irvin, 1996). Moreover, the members of teams could also use training in areas like team problem-solving, conflict management, and meeting management (Joinson, 1999; Mazany & Francis, 1995).

The title of this paper, *Building Team Collaboration in the Virtual Classroom*, uses two terms, *team* and *collaboration*, which may appear at first glance to be redundant. People do not become collaborators, however, merely because they are grouped into teams. Just like any other ability, effective collaboration involves a set of skills that needs to be learned and cultivated. This becomes especially important in a virtual realm where team members may not be able to meet face-to-face.

The benefits of collaboration and team skills have long been recognized in both business and academic settings. In a study involving a team of business professionals performed in 1967, Maier concluded that teams have a distinct advantage over individuals in that they have a greater pool of knowledge, receive more input and solutions to problems, and encourage a better collective acceptance and understanding of group decisions. A more recent study of student teams concluded that team projects develop individual collaborative skills, strengthen both individual and group commitment to teamwork and prepare students for the 21st century workplace (Rooney, 2000).

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Review of the Literature

Teambuilding Training

Barker and Franzak (1997) believe that it is "prudent" for educators to provide needed experience and information to prepare students to be better team members. For online teams, this training should also include technical support and technology training on the hardware and software used to support online teamwork (Duarte & Snyder, 1999).

Team training and development should also be ongoing to include teambuilding interventions that are matched to the specific needs of the team. For example, an intervention to improve problem-solving skills may have little impact on a team experiencing difficulties developing workflow processes. Similarly, McClure and Werther (1993) determined that specific team interventions that target personality characteristics assisted teams in identifying and resolving personality-based barriers by improving interpersonal communication and teambuilding.

Team lifecycles should also be carefully considered before implementing training. Teams exist on a continuum: from short-term project teams to relatively permanent teams (Tannenbaum, Beard, & Salas, 1991). Druskat & Kayes (2000) propose that many popular teambuilding models are inappropriate for short-term project teams. For example, the conflict depicted as inevitable during the "storming" stage of Tuckman's (1965) team-development model (i.e., forming, storming, norming, performing) might confuse or obstruct short-term project teams whose lifecycle is too brief to benefit from this information (Porter & Lilly, 1996).

Finally, in educational settings, teambuilding interventions that encourage establishing clear responsibilities, procedures, and due dates for team members may have some positive impact on team performance but may also reduce exploration or risk-taking among team members that they might otherwise use to seek answers and make decisions, which could compromise team learning (Druskat & Kayes, 2000).

Elements Found in Successful Teams

Successful teams share certain characteristics or traits. For the purposes of this investigation, these characteristics or traits were labeled "elements found in successful teams." These elements included receiving organizational or instructor support, becoming acquainted with team members, establishing effective communication, building trust, and developing effective online organization strategies (DeNigris & Witchel, 2000; Duarte & Snyder, 1999).

Receiving Support

The literature often cites organizational and management support as the major factor in team success (Berry, Avergun, & Russ-Eft, 1993; Haywood, 1998). In educational teams, a lack of support from the instructor causes anxiety and frustration among students and adversely affects team effectiveness (Hara & Kling, 2000). Oliver, Omari, and Herrington (1998) recommended that online instructors should *scaffold* their support to students. They describe *scaffolding* as providing increased support at critical times, such as at the beginning of instruction when students must learn new information or skills, and tapering off as students become more experienced.

The element, "support," encompasses providing encouragement, information, and resources; responding to team requests promptly; helping to provide team direction; acting as an arbitrator; and backing the decisions of teams (Duarte & Snyder, 1999; Eales-White, 1997; Haywood, 1998). In knowing what constitutes receiving support, team members can play a more active role in obtaining it.

Getting Acquainted

Berliner (1991) wrote, "education—even when carried out with personal computers—is an inherently social process" (p. 50). Although building relationships in online environments is difficult, it is essential to team effectiveness (DeNigris & Witchel, 2000; Haywood, 1998). Research has indicated a positive link between team member relations and team performance in both short-term teams (Druskat & Kayes, 2000) and in long-term teams (Druskat, 1996; Goodman & Leyden, 1991). The familiarity that individual members develop within their teams helps them to predict each other's behaviors and match their strengths and interests to tasks (Cannon-Bowers, Salas, & Volpe, 1995).

The element, "getting acquainted" encompasses sharing cultural information which includes sharing beliefs, values, assumptions, and opinions; personal information that includes sharing interests, hobbies, work life, family life, personal web site, hours of availability, personal expectations of the team, types of computer connections, equipment, and skills (Duarte & Snyder, 1999; Haywood, 1998).

Establishing Communication

Much of human communication is inherently ambiguous. In face-to-face situations, however, people are more apt to resolve these ambiguities. As Hara and Kling (2000) found in a study of graduate students who were taking an online course, resolving communication ambiguities can be much more difficult in synchronous and asynchronous online situations where the primary means of communication is written text. In a separate study of graduate students enrolled in an online educational technology course, Talley (1997) found two underlying problems specific to online communication and distance education: 1) students who easily communicate face-to-face found online contact more difficult due to limited typing skills, and 2) synchronous discussions required a speed of response and attentiveness that was demanding, while students generally prefer time to reflect on ideas before responding to them.

Establishing clear communication is fundamental to all aspects of online teams. For example, teams must communicate effectively in order to establish clear and specific goals and objectives so that they may function effectively as a team (Larson and LaFasto, 1989). Yukl (1994) maintains that teams that do not clearly communicate their goals will be fraught with disagreement about priorities and processes for accomplishing objectives.

Three ways to foster effective online communication include: 1) limiting interference which entails being prepared for online team meetings, being timely, using technology effectively, and asking questions when messages are unclear (Duarte & Snyder, 1999; Haywood, 1998); 2) encouraging open communication which entails being informal, incorporating humor, being honest and thoughtful, and providing motivational and positive messages to teammates (Duarte & Snyder, 1999; Hara & Kling, 2000); and 3) building rapport among teammates which entails occasionally engaging in team activities or discussions that are not work-related (Barker & Franzak, 1997, Oliver, Omari, & Herrington, 1998).

Building Trust

Geber (1995) determined that face-to-face contact was necessary to establish trust within teams. In a study of virtual organizations, Handy (1995) corroborated Geber's conclusion when he proposed that trust may not be possible in global virtual teams because it requires "touch," that is, direct face-to-face exchanges. Conversely, Jarvenpaa, Knoll, and Leidner (1998) found a positive relationship between the levels of trust and the amount of cohesiveness, satisfaction, and perceived effectiveness among online team members. According to Jarvenpaa and Leidner (1998), although the usual cues used to convey a sense of trust, such as warmth, attentiveness, and other expressive behaviors, are somewhat lacking in the virtual realm, experienced online team members display trust behaviors in other ways. That particular trust, however, is delicate and provisional.

While developing trust in a virtual environment requires a more conscious and planned effort (Duarte & Snyder, 1999), once it is developed, trust enhances group learning and development (Braaten, 1974; Mann, 1975) and it allows teams to manage conflict more effectively to become more productive and creative (Dee, 1995). Conflict is a reality of team experience and the willingness and ability to resolve personal conflict is crucial to team success (Hequet, 1994; McClure & Werther, 1993). Although several researchers recommended the golden rule, "treat others as you would like to be treated" for resolving conflict and building trust (Dee, 1995; DuBrin, 1995; Gardenswartz & Rowe, 1994). Kezar (1998) and Manz, Neck, Mancuso, and Manz (1997) suggested a somewhat modified golden rule that embraced the diversity found in online teams. They urge team members to discover how other people on their team want to be treated and then act accordingly.

In online teams, the element, "building trust" encompasses acting with integrity toward teammates, respecting others, committing to the team effort, resolving conflict constructively, being reliable, and being honest (Duarte & Snyder, 1999; Haywood, 1998; Iacono & Weisband, 1997).

Getting Organized

The research of Langer (1997) and Druskat & Kayes (2000) revealed an inverse relationship between clearly defined project goals and learning. Specifically, a decrease in structure and specifics of a project results in an increase in learning and vice versa. Langer (1997) describes this phenomenon as the need for "mindfulness" or thought and attention to changing ideas and circumstances, which, she argues, increases learning. Conversely, other studies involving project teams revealed that developing clear plans, goals, and priorities is positively associated with team efficiency (Ancona & Caldwell, 1992; Ko & Rossen, 2001) and performance (Porter & Lilly, 1996).

Duarte and Snyder (1999) described a virtual environment as inherently chaotic and advocate the use of clear procedures and organization guidelines within online teams. In their book on virtual teams, they outline several strategies, tools, and techniques to help online teams be more organized and, they argue, be more satisfied and successful. For example, they use checklists and worksheets to highlight critical success factors found in effective teams; they provide sample agendas to help confirm team missions; and they use scenarios and exercises to encourage spontaneous and reflective thinking to develop problem-solving skills.

In online teams, the element, "getting organized" encompasses selecting a team leader, recognizing and rewarding team accomplishments, facilitating team meetings, developing team norms, instituting workflow procedures, creating time lines, and selecting the appropriate technology and method for team interactions (Duarte & Snyder, 1999; Haywood, 1998).

Conclusion

Research that emphasizes the value to learners of online instruction that includes collaboration (Druskat and Kayes, 2000) coupled with findings concerning the discrepancies and poor quality of online resources available to instructors (Hara and Kling, 2000), underscore the need for developing more resources on online teambuilding.

The literature review also calls attention to the need for further research of virtual teams. Hara and Kling (2000) encouraged further research on the impact of support on students enrolled in online classes. They point to problems and disappointments of students who lack the support they need to be successful in online courses. Based upon this collection of research, guidance from instructors, content experts, and peers, a web-based instructional module on teambuilding was developed to aid both students and instructors who are involved in online courses which have team projects.

Methodology

During the Summer 2000, two investigators collaborated to develop a web-based teambuilding instructional module (module) to be used as part of an instructional design study. The investigators developed instruments to measure various aspects of learners before and after the learners completed the module. The purpose of the module was to improve online collaboration skills and attitudes of people who produced online projects as teams. The investigators worked together to implement the module and to gather data focusing on teambuilding skill levels of online learners and on general attitudes toward teambuilding instruction and the collaboration process.

Online Teambuilding Instructional Module

The online teambuilding instructional module consisted of an online *PowerPoint* presentation and an activity worksheet. It provided practical information and practice with elements found in successful online teamwork. These elements included information on receiving organizational or instructor support, becoming acquainted with team members, establishing effective communication, building trust, and developing effective online organization strategies. The instructional module created for this study followed a modified version of Dick and Carey's (1996) Instructional **System Design Model.**

The module was web-based and was accessible to learners via a virtual teambuilding (VTB) web site designed by the investigators. Learners who did not have high-speed Internet access were provided with a duplicate version of the teambuilding *PowerPoint* presentation that was downloadable to their computer desktop.

The web site housing the module also included a Pre-Course Survey and Post-Teamwork Survey. These surveys measured learner satisfaction with his or her team projects, and the skills they gained for online collaboration following the instruction they would receive from the module. Data on prior experience with relevant online collaborative technologies was also gathered using these surveys and was to be used to group learners of the study into teams for purposes of collaborating on team projects.

Objectives

There were four objectives for this study. The first objective was to explore whether or not online learners valued the VTB instruction they received as preparation for online team projects. This objective was measured in terms of: 1) online learner satisfaction with the two components that comprised the instruction: an online *PowerPoint* presentation on virtual teambuilding and a teambuilding activity worksheet, and 2) online learner perceptions of instruction as contributing to their individual personal growth as learners and educators.

The second objective was to explore how online learners who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team. This objective was measured in terms of online learner satisfaction with individual team experiences encompassing elements found in successful online teams: receiving support, getting acquainted, building trust, building communication, and getting organized.

The third objective was to determine the online collaboration skills online learners gained after they had completed the module. This objective was measured by comparing results from individual pre-course surveys with post-teamwork surveys that contained specific questions about knowledge and skill levels when working in online collaborative teams.

The fourth objective was to determine whether learners believed that they would use the online teamwork skills and knowledge they gained from the instructional module in future online collaborative teams. This objective was measured by the responses students gave concerning their attitudes toward using the online team skills they developed in future online collaborative situations.

Target Audience

The target audience for the teambuilding instructional module is adult learners who are engaged in online, collaborative projects as part of a virtual team. The ultimate intended purpose of the module is to be available to any person who has Internet access at anytime and at any location. Additionally, while it was written in English, the overall theme, the language, and graphics used throughout the module were specifically designed to be inclusive of other cultures.

Participants

This study addressed itself to a sample drawn from a group of graduate students who were enrolled in an online course. This course was being offered at the University of Hawaii, Manoa (UHM) for the Fall 2000 Semester. The instructor for this course had extensive experience with the content of the course and with distance learning. Course content, schedules, and feedback were given via an online university network called Web Course Tools (WebCT). This particular class was selected because it represented the target population in that it contained a mix of male and female adults from various ethnicities who were involved in online collaborative projects.

There were a total of 27 students enrolled in the online course—10 male and 17 female. The cultural backgrounds of the students were Chinese, Swedish, Hispanic, Japanese, Filipino, and Caucasian American. This module was administered to 24 of the 27 enrolled students. Two students opted not to participate and one student was disqualified because she was also one of the investigators. Although only the results of 24 of the 27 students were considered as part of the study, the whole class received the same treatment.

Procedures

This module was administered to all students enrolled in the Fall 2000 online class. Before the class began, the instructor and an investigator, in the role of Teaching Assistant, sent out a surface mail letter and an email to prospective students to provide them with general course information as well as to describe the VTB web site and how to access it.

In order to incorporate the online teambuilding module, the instructor designed an introductory unit. This unit contained the first graded assignments for the course. Assigning grades to the Teamwork Unit and online team projects provided incentives to the learners.

For the first teambuilding session, students were to meet in an online chatroom in WebCT with their instructor and the course Teaching Assistant. It was mandatory for every student to be present, but they had the option of meeting in a morning or evening session. There were no other mandatory online meetings scheduled.

Access to the course site, which contained a link to the VTB web site, was permitted a few days before class actually began. The VTB site outlined six steps that students would need to follow in order to complete the teambuilding process.

Step 1 was to fill out an electronic Pre-Course Survey form. A link was provided to the survey. The survey contained items concerning demographics, types of computer and Internet connections, student online experience levels, and experience levels of students with virtual teams.

Although students were required to participate in the Pre-Course Survey, several items on the survey were optional. At the bottom of the survey form, students were notified that information from their surveys was requested to be used in the teambuilding study. Besides investigative purposes, the information from the surveys was also used to establish heterogeneous teams. For example, to provide students with a greater chance of success when placed on teams, the investigators used the Pre-Course Survey data to optimize the placement of students onto teams in the following ways: 1) to equip the online teams with the optimum number of three people (Stadtlander, 1998), team assignments were planned that way; 2) to facilitate transferring data among team members, students were matched according to computer types, that is, PC or Macintosh; 3) to provide a range of experience levels and genders, student teams were deliberately mixed.

After completing the Pre-Course Survey, students were instructed to view the twenty-minute *PowerPoint* presentation entitled, "Recipes for Satisfying and Successful Virtual Teams," that was developed by the investigators. It was listed as Step 2 of the teambuilding process. They could view the presentation online or download it to view it from their computer desktops. At the end of the presentation, students were given an opportunity to print a copy of the presentation for future use.

In keeping with the cooking theme of the presentation, the elements of satisfying and successful teams were broken down into "ingredients." Haywood (1998), and Berry, Avergun, and Russ-Eft (1993) established "support" as the most essential ingredient for satisfying team experiences, so a checklist was developed for the instructor to go through with the class in a virtual chatroom describing how she would support the teams. This online class chat was labeled Step 3 of the teambuilding process. The checklist provided a general topic outline for the instructor to follow as she talked with the students. The instructor committed to support the teams by being available to act as an arbitrator, providing key information, and helping to guide teams toward the project goals. She also pledged to be available when called upon for assistance, but not to exert undue influence on the creativity or bonding of team members. At the end of the chat session, students were provided with a list of their teammates for the two assignments requiring teams.

Step 4 of the teambuilding process involved students making arrangements with their teammates to meet in a virtual chatroom to engage in teambuilding activities together using the worksheet as a guide. They were encouraged to do this as soon as possible because they only had one week to complete the activities. The activities were provided to the students as a printable activity worksheet available from the VTB web site. Students were directed to read through the activities before meeting with their teammates so that they would become familiar with what each of the activities involved and have some time to reflect on the questions. It was anticipated that these directions would facilitate the first online team meeting and make it as productive as possible.

Step 5 of the teambuilding process involved students posting individual results of their online team meeting including reflections, comments, and questions they had regarding the teambuilding activities and the teambuilding process in general in an online Teambuilding Forum.

Once the two required collaborative projects were completed, students were directed to go to the VTB web site to take a Post-Teamwork Survey. This was labeled Step 6 of the teambuilding process. The survey was used to explore student perceptions of their team experiences, the role of the module in their perceptions of their team experiences, the role of the module in increasing their online collaboration skills, the likelihood that they would apply the skills they learned in future online teams. Finally, at the end of the Post-Teamwork Survey, a comment section was provided. Students were urged to provide feedback about the teambuilding instruction and activities, the personal experiences they had in the assigned online teams, and their satisfaction with their team experiences.

Instruments

Three research instruments were used to gather demographic data and to measure student satisfaction levels. These included a Pre-Course Survey, Post-Teamwork Survey, and electronic postings to an online Teambuilding Forum where students discussed experiences with the online instructional module and team experiences in general. For purposes of confidentiality and analysis, the electronic postings were condensed to comments related specifically to student perceptions about the module and team experiences.

Data Gathering Process

Data generated by two online surveys, arranged chat sessions, and electronic Teambuilding Forum postings were used to obtain data relating to skills gained and satisfaction levels of students who developed online team projects. Participants released these data for the purposes of this study.

Data Analysis and Results

Four objectives were measured for this study using quantitative and qualitative data. Multiple-choice questions were used to measure quantitative data and were collected from two surveys: the pre-course survey and the post-teamwork survey. Comments from the online learners were used to provide qualitative data and were collected from chat sessions and the electronic Teambuilding Forum postings.

Survey Questions

The first objective was to explore whether or not students valued the VTB instruction they received as preparation for online team projects. Overall, responses indicated that this objective was met in terms of student satisfaction with the two components that comprised the instructional module, and student perceptions of instruction as contributing to their individual personal growth as learners and educators. Twenty-three out of the twenty-four students indicated that they valued the VTB instructional module.

The second objective was to explore how students who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team. An overwhelming majority of the student responses indicated that they were satisfied with individual team experiences encompassing elements found in successful online teams: receiving support, getting acquainted, building trust, building communication, and getting organized.

The third objective was to determine the online collaboration skills students gained after they had completed the module. Twenty-two of the students out of twenty-four acknowledged that they gained skills and knowledge essential to online collaboration.

The fourth objective was to determine whether students believed that they would use the online teamwork skills and knowledge they learned from the instructional module in future online collaborative teams. More than twenty of the students indicated that indeed they would use these skills and knowledge.

Student Comments

To substantiate some of the numerical data gathered, the investigators asked students to comment on various aspects of the module and their online team experiences. The following themes emerged from the data: *receiving support, getting acquainted, establishing communication, building trust, getting organized, teambuilding presentation, teambuilding activities, teambuilding module*, and *overall team experience*.

Receiving Support

There was only one comment that related specifically to student perceptions of the online support they received and it was positive: "I enjoyed this course and appreciate the hard work and dedication of the teaching assistant and the instructor."

Getting Acquainted

A total of 11 comments related specifically to student perceptions of how well their team became acquainted. Again, these comments were all positive ranging from, "[I] felt very fortunate to have two good teammates" to "**GO TEAM!**"

Establishing Communication

There were a total of nine student comments concerning communication. One student wrote, "Our backup communication plan is [first] external email and then by telephone." Other student comments were somewhat more revealing of their attitudes toward communication. For example, a student commented on the value of communication to the team, "We ended our chat by talking about the importance of keeping communication lines open by checking email daily and to call each other if necessary." Finally, since the module presented instruction on how to communicate more efficiently using acronyms and more expressively using emoticons, many students commented on how they felt about the instruction in these terms. Two typical comments included: "We introduced some clever and amusing emoticons and acronyms" and "Our 'favorite' emoticons and acronyms: ;-) LOL :o) :Q TTYL BRB :-) AKK."

Building Trust

There were a total of three comments relating specifically to perceptions of trust developed in teams and all were positive. A typical comment was, "…everyone was reliable and committed to the team."

Getting Organized

Eleven students commented on their perceptions of team organization. A few comments indicated a feeling that students were satisfied with how their team organized their work. For example, one student wrote, "We were able to work well together." The majority of the comments, however, were neutral, indicating methods of team organization only: "[We used] a sequential order and our editing path was determined," and "Whenever we get any files from any teammates, we will send a quick reply to inform of our receiving."

Teambuilding Presentation

A total of nine students commented on their perceptions of the *PowerPoint* Teambuilding Presentation. The majority of comments were positive: "All agreed that the teambuilding *PowerPoint* Presentation was well designed, had excellent tips, and would serve as a great reference for upcoming team projects." "The *PowerPoint* Presentation is a helpful guide for teambuilding. It was well organized and informative." There was one slightly negative comment, however, concerning the length of the presentation: "The presentation is pretty long, but it is really useful."

Teambuilding Activities

There were a total of 11 comments that related specifically to student perceptions of the teambuilding activities. Of all the comments made by students, this particular set of comments was the most revealing of student attitudes. The majority of comments were positive, with only one comment being neutral. Typical comments included: "I really enjoyed our teambuilding chat" and "The [teambuilding] exercises worked well to get us going."

Complete Module

There was only one student comment related to the complete module and it was positive: "The whole presentation is really easy to understand."

Overall Team Experience

Only one comment was related to student perceptions of the overall team experience and it was exceedingly positive: "The overall team experience definitely built my confidence to participate in similar activities in the future."

Discussion

From student responses relating to satisfaction with the entire module and its specific components, overall student attitudes toward the instructional module were favorable. The *PowerPoint* presentation component received a slightly better rating than the Teambuilding Activity Worksheet component.

The responses of the students relating to their individual personal growth as learners and educators demonstrated the value of the module. Overall, their opinions indicated that they felt their personal learning increased, their personal creativity increased, and their personal collaboration skills improved after receiving teambuilding instruction from the module and participating in online teams for the team projects. The comments from students describing their enthusiasm going into their teamwork included specific language and ideas taken from the teambuilding module they had just completed. For example, students commented on specific file naming systems they would use, types of editing paths they would implement, and ways they would communicate and build trust. It is evident that students had clear intentions derived from the module of what would make their online teamwork more satisfying and successful going into the team projects.

The students' satisfaction with the instruction of the online teambuilding module combined with their reports of increased learning, increased creativity, and improved collaboration skills help to strengthen the finding of Pascarella et al. (1998) that student satisfaction with instruction ultimately leads to success. Although Pascarella's study involved only face-to-face instruction, this positive relationship between student satisfaction with instruction and their subsequent success appears to apply as well in online courses using any type of instruction.

Student responses and comments on the Post-Teamwork Survey indicate that they did indeed perceive their online team experiences as satisfying and successful. The students rated their experiences according to the elements found in successful online teams: getting acquainted, receiving support, establishing communication, building trust, and getting organized. Students ranked receiving support as the most important element for their success as online team members. This finding supports the work of Berry, Avergun, and Russ-Eft (1993) and Haywood (1998) who asserted that receiving support was the major factor in team success.

Contrary to the expectations of the investigators who assumed that the module would be more rewarding to the students with less online technology experience, students with more experience seemed to value the module more than students with less experience. One possible explanation for the higher ratings of the students with more experience may be that these students felt more secure using an online instructional module and were able to glean more from it. This explanation lends further support to Sherry's (2000) finding that greater experience with technology reduces anxiety and fosters positive attitudes toward online technology.

Half of the comments from the students spoke directly to the applicability of the module indicating they valued the skills they learned enough to use them in their future roles as educators and collaborators. Additionally, the positive responses students made on the Post Teamwork survey reflected that indeed they would apply their skills towards future situations involving online collaboration. This may substantiate Rooney's (2000) conclusion that online collaboration is a skill necessary for the 21st century workplace.

Implications

The findings of this investigation have several implications: 1) the online teambuilding module used in this study does have an overall positive effect on team attitudes; 2) students who develop online collaborative projects and undergo online teambuilding instruction that includes teambuilding activities have a high satisfaction rate with their online teams; 3) students who learn online teambuilding skills do apply them to their online collaborative work; 4) students value the online teambuilding skills they learned to the extent that they indicated that they would apply to future online collaborative work; 5) instructors who assign online collaborative projects should consider incorporating teamwork instruction in their online classes; and 6) the elements found in successful teams, receiving support, getting acquainted, establishing communication, building trust, and getting organized, are also elements found in teams satisfied with their online teamwork.

Future Studies

Since a number of the students from this study wrote positive comments about their teammates and their experiences, the investigators believe that this may have implied that the manner in which teams were formed was done successfully. A study of the combination of characteristics used to form the teams could lead to interesting findings.

Additionally, as of this writing, the investigators have received a number of inquiries about the module from business entities. These inquiries warrant future research be conducted beyond the academic environment.

Finally, support plays a critical role in the success or failure of a team (Berry, Avergun, & Russ-Eft, 1993; Haywood, 1998). For this particular study, the investigators developed a checklist for the instructor that emphasized the important ways that she could offer her personal support to the online teams. In the future, however, a web-based information guide or pamphlet might be distributed to instructors describing specific ways that they can support online teamwork.

The researchers for this investigative study developed workshops to instruct faculty members at the University of Hawaii at Manoa and at Hawaii Pacific University on how they might support virtual team collaboration for their online courses. Overall, the workshops received positive feedback from the attendees. Evaluations from these workshops and others like it may also contribute to a database for further research.

VTB Web Site Access

The overwhelming positive response from students combined with the enthusiasm of educators and business professionals have led the researchers to currently work towards marketing their VTB module. However, at present, they do allow educators full access to it in return for feedback on its usefulness and suggestions for its improvement. To view a web site that provides samples taken directly from the full VTB web site, please visit: <http://members.home.net/vtbsolutions>. You may also email the researchers to request permission for access to the full VTB web site at: <vtbsolutions@hotmail.com>. Please include your name, title, institution, and how you would like to use the web site.

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THE RELATIONSHIP OF STUDENT MOTIVATION AND SELF-REGULATED LEARNING STRATEGIES TO PERFORMANCE IN AN UNDERGRADUATE COMPUTER LITERACY COURSE

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Introduction

Recent research has shown that self-regulated learning is an important aspect of student academic performance in the classroom. Self-regulated learning can be defined as a student's use of specified strategies to achieve academic goals on the basis of self-efficacy perceptions. Students practicing self-regulation behaviors initiate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents, or others. In general, self-regulated learning consists of three essential elements: commitment to academic goals, self-efficacy perceptions, and self-regulated learning strategies (Zimmerman, 1989).

Student academic goals are the underlying reasons or purposes for the students' learning behaviors. They represent the meaning that students assign to achievement situations. These goals provide a sort of cognitive organizational structure that encompasses how students define their successes and failures, affective reactions, and future behaviors (Urdan, 1997). Researchers on achievement motivation have found that different types of goal orientations elicit different motivational processes (Ames & Archer, 1988).

Academic goals are most often described as either mastery or performance goals. Students possessing mastery goals are considered to be intrinsically motivated, primarily focusing on learning or mastering the course material. Because they value the learning process itself, these students often seek out challenging assignments and put forth more effort to learn the material. They also tend to use more effective learning strategies while studying. In contrast, students with performance goals are considered to be extrinsically motivated. These students tend to focus on the outcome of their learning and are primarily interested in earning a good grade in the course, or gaining social esteem (Dweck, 1986; Pintrich 1995). Since they are mostly concerned with the reward that comes after they have learned the material, they tend to use less effective learning strategies. For students with performance goals, learning the material is often seen as a means to an end rather than an end in itself.

Although student goals provide direction and incentive for academic work, a second self-regulation element affecting student achievement is the students' beliefs about his or her ability. Belief in ones' ability to successfully perform a particular task is known as self-efficacy. Bandura (1986) stated that self-efficacy beliefs influence an individual's willingness to attempt a particular task, the level of effort he or she will employ, and his or her persistence in accomplishing the task. Self-efficacy is particularly important because of its two-fold effect on the other components of self-regulation. Not only does self-efficacy influence the type of goals students set for themselves but it also affects the amount of effort they invest in working toward these goals (Pintrich, 1995).

Previous research on self-efficacy has indicated that student behaviors can often be better predicted by their beliefs about their capabilities than by what they are actually capable of accomplishing. Results have shown that people's beliefs help determine what they do with the knowledge and skills that they have (Pajares & Miller, 1994). Typically, students with high-self efficacy are confident in their skills and abilities to do well and have been shown to participate more in learning activities, show greater effort and persistence, and achieve higher levels of academic performance than students with low self-efficacy (Pintrich & De Groot, 1990; Schunk, 1991). Even when experiencing difficulty, students with high self-efficacy tend to work longer and harder than do students with low self-efficacy. On the other hand, students with low self-efficacy frequently show less persistence and may attempt to avoid the learning situation altogether (Hagen & Weinstein, 1995). Lack of self-efficacy has also been coupled with the debilitating affect of high test-anxiety (Bandura, 1986).

A third element of self-regulation consists of student's learning strategies. Self-regulated learning strategies are the behaviors and actions students use to acquire desired information or skills. They include such methods as organizing and applying new information, self-monitoring one's performance, seeking assistance, and managing time and study environments (Pintrich, Smith, Garcia & McKeachie, 1991; Zimmerman, 1989; Zimmerman & Martinez-Pons, 1986). Students' use of self-regulated learning strategies depends not only on their knowledge of strategies but also on their academic goals and self-efficacy perceptions. Students with learning goals tend to use deep processing strategies that enhance their understanding of concepts. They attempt to integrate information and monitor their comprehension (Pintrich & Garcia, 1991). Conversely, students with performance goals, tend to use strategies that promote only short-term and surface level processing, like memorizing and rehearsing (Graham & Golan, 1991).

In much of the previous research on self-regulated learning, the focus has been on determining the foundational elements of the construct and the relationship between these elements. The results of this work have indicated that self-regulatory processes are linked with content domains, and individuals learn how to apply these skills in a given learning or applied context

(Zimmerman, 1998). Determining the specific self-regulatory processes associated with successful learning in particular content domains is an important next step in this line of research.

Computer Literacy courses are offered by many colleges and universities and are often taken by students from various academic majors. For many students, this course is a requirement of their degree programs. For others, the importance and applicability of the content information are influential factors in their desire to take the course. Very often, student enrollment in these courses may be as high as two- to three-hundred students per semester. Because Computer Literacy courses are so prevalent and the content a necessity to many college students, it is important to determine the relationship of motivation and learning strategies affecting learning and performance in these courses. It is also important to discover the various approaches and methodologies undergraduate students report they use to learn the course material.

The purpose of this study was to determine the relationship among students' reports about their goal orientation, self-efficacy and self-regulated strategy use and their academic performance in a Computer Literacy course as indicated by course grade. We also investigated students' reports about their most preferred and utilized study techniques and the techniques they used to monitor their learning in this course.

Method

Subjects

All participants in this study were students in a general studies Computer Literacy course at a large university in the southwest. Of the 291 participants, 193 were female and 98 male. The majority of the participants were education (27%), communication (18%), or broadcasting (11%) majors. In total, 26 different academic majors were represented. Four percent were freshman, 27% sophomores, 47% juniors, 21% seniors, and 1% graduate students. Students ranged in age from 18 years to 50 years, with an overall average age of 22.

Procedures

The Computer Literacy course was a multi-section course consisting of a lecture class and lab. The lecture portion of the course met in a large lecture hall twice a week for 50 minutes, while the lab section met in a PC computer lab once a week for a period of one hour and 50 minutes. In total, there were 17 lab sections for this course. Data were collected at the end of the fall 2000 semester during lab sections in which students were completing their semester final exam. In each lab section, the investigator described the survey, "Strategies Used for Learning in a Computer Literacy Course". Students completed the survey after finishing their final exam. Participation in the study was voluntary. Students were given two extra credit points toward their course grade for completing the survey.

Materials

The participants completed the survey "Strategies Used for Learning in a Computer Literacy Course". This survey consisted of three sections. The first section included demographic questions as well as selected response questions regarding the lowest grade they would be happy with in this course, and how many hours a week they study for this course. Participants were also asked to respond to a series of yes or no questions aimed at discovering their reasons for taking this course. Examples of these questions were, "The course is required for my major", "The content seems interesting", "It is an easy elective", and "It will improve my career prospects".

The second section of the survey included 73 motivation and learning strategies questions adopted from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et.al., 1991). The MSLQ is a self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies. The motivation section of the MSLQ consists of six sub-scales with items designed to assess students' goals and value beliefs for a course, their beliefs about their skills to succeed in a course, and their anxiety about tests in a course. The learning strategy section consists of nine sub-scales with items regarding students' use of different cognitive and metacognitive strategies as well as management of various resources. Students rate themselves on a 7-point Likert scale (1 = not true of me, to 7 = very true of me).

The various sub-scales on the MSLQ can be used together or separately. Two learning strategy sub-scales, Rehearsal, and Help Seeking, were not used in this study due to the lower Cronbach alpha scores published by Pintrich et.al. (1991) for these scales (.69, and .52 respectively).

The third section of the survey consisted of eight questions, two selected-response and six open-ended, focusing on student study habits. The selected-response questions asked students if they study differently for this class than for their other classes and who is responsible for their success in learning, themselves or their instructor. The open-ended questions asked participants to describe two ways that they study for this class, two ways that they study for their other classes, how they check their understanding of the material while studying for this course, what is their major strength as a learner, what is their major weakness as a learner, and what they think would help them become better learners.

Data Analysis

Using the method developed by Pintrich et.al. (1991), the MSLQ sub-scale scores for each participant were constructed by taking the mean of the items that make up that scale. For example, intrinsic goal orientation has four items. An individual's score for intrinsic goal orientation was computed by summing the four items in the sub-scale and taking the average. There are some negatively worded items and the ratings were reversed before an individual's score was computed. The statistics reported represent the positive wording of all the items. In general, a higher score of 4, 5, 6, or 7 for a sub-scale mean score indicates that the student feels the items were a fairly good representation of their motivational orientation or learning strategies used in this course.

Multiple regression analysis for two unordered sets of predictors was used to evaluate how well the use of specific motivation and learning strategies predicted course grade. The Holms Method was used to control for Type I error.

The responses to each open-ended question were analyzed and categorized by discernable themes. The number of responses in each thematic category was then calculated. Responses to the selected-response questions were compiled and summarized by frequency of occurrence.

Results

Three sets of analyses were conducted and results are organized accordingly. The first set consisted of multiple regression analyses examining the MSLQ responses and their relationship to course grade. In the second set of analyses, frequencies of responses and the thematic categories to the eight study-habit questions were determined. In the last set of analyses, the students' answers to the selected-response general course questions were analyzed and summarized.

Results from MSLQ Assessment of Student Motivational Orientations and Learning Strategies

Table 1 displays the means and standard deviations for course grade and scores on the MSLQ sub-scales. Significant sub-scale mean scores will be discussed along with mean scores for individual items on these sub-scales.

Table 1 Mean Scores and Standard Deviations on Course Grade and MSLQ Sub-scale Summaries

Variables		Mean	Standard Deviation
Course Grade		2.73	.98
Motivation Scales	Intrinsic Goal Orientation	4.62	1.10
	Extrinsic Goal Orientation	5.00	1.23
	Task Value	5.10	1.18
	Control of Learning Beliefs	5.18	1.06
	Self-Efficacy for Learning and Performance	5.32	1.07
	Test Anxiety	3.87	1.46
Learning Strategy Scales	Elaboration	4.21	1.16
	Organization	3.71	1.33
	Critical Thinking	3.49	1.24
	Metacognition	4.01	.94
	Time and Study Environment Management	4.31	1.10
	Effort Regulation	4.25	.85
	Peer Learning	3.06	1.52

Note: Sub-scale mean scores can range from 1 to 7.

The possible mean scores for the MSLQ sub-scales can range from one to seven. The selection of a one for an item on a sub-scale indicated that the student believed the item was not at all true of them, whereas a selection of seven indicated that the student believed the item was very true of them. The scores for all the individual items on the sub-scale were then averaged together to determine the mean score for the sub-scale.

The range of final course grades was from A through E. The numeric value associated with each grade was A = 4, B = 3, C = 2, D = 1, E = 0. Final course grades resulted in the following distribution: A= 65 (22%), B = 120 (42%), C = 75 (26%), D = 24 (8%), and E = 7 (2%).

Motivation Sub-scale Results

In response to the sub-scale items on the motivation scale, participants rated extrinsic goal orientation and self-efficacy fairly high, as indicated by the Extrinsic Goal Orientation and Self-Efficacy for Learning and Performance sub-scale mean scores. The mean score for the Extrinsic Goal Orientation sub-scale was 5.0 and Self-Efficacy for Learning and Performance was 5.3. Additionally, participants appear to not worry about course tests as indicated by a mean score of 3.8 on the Test Anxiety sub-scale.

Extrinsic goal orientation sub-scale results.

There were four items on the Extrinsic Goal Orientation sub-scale, with three items focusing on the importance of course grades and one item focusing on the approval of others. Mean response scores for each of the three items asking students to rate the importance of earning high course grades were fairly high, with each item mean score over 5.0. These items asked students to rate their satisfaction, value, and desire to earn a grade higher grade than their classmates. Based on the mean scores for each item, it appears that earning a good grade was a goal of many students.

The one item on the sub-scale focusing on the importance of earning a good grade in order to receive approval from others had a mean score of 4.3. The mean score is approximately at the midpoint of the scale range, indicating that for some students, earning a good grade was important in order to prove their ability to others.

Self-efficacy for learning and performance sub-scale results.

There were eight items on the Self-efficacy for Learning and Performance sub-scale, with five items focusing on the students' judgment about his or her ability to accomplish the tasks for the course, and three items focusing on the students' expectation for success in the course.

Mean response scores for the five items focusing on the students' beliefs about being able to accomplish the tasks for the course were positive and ranged from 4.7 to 6.1 on the seven-point scale. These items asked students to rate their beliefs in their ability to understand both basic and complex course material, and their confidence in performing well on course assignments and tests.

Mean response scores for each of the three items focusing on the students' expectancy for success were also very positive and ranged from 5.1 to 5.6. These items asked students to rate their beliefs on being able to earn an excellent grade, and their beliefs in their overall ability to do well in the course.

Test anxiety sub-scale results.

There were five items on the Test Anxiety sub-scale, with three items focusing on worry or negative thoughts during test taking and two items focusing on physiological arousal aspects of anxiety, such as upset feelings, and rapid heart beat

The mean response scores for the three items focusing on worry were approximately at the mid-point of the seven point scale, ranging from 3.2 to 4.2. These mean scores seem to indicate that for most students, they were not worrying about the possibility of a poor performance or even failure during test taking.

The mean response scores for the items focusing on the physiological aspects of anxiety were 3.6 and 4.2. These mid-range mean scores indicated that most students were not upset or did not have uneasy feelings during test taking.

Learning Strategy Scale Results

In response to the learning strategy items, participants rated elaboration fairly high and peer learning fairly low as indicated by the Elaboration and Peer Learning sub-scale mean scores. The mean score for the Elaboration sub-scale was 4.21 and Peer Learning was 3.06.

Elaboration sub-scale results.

There were six items on the Elaboration scale all focusing on study techniques that help students integrate and connect new information with prior knowledge. Mean response scores for these items ranged from a low mean score of 3.0 to a fairly high mean score of 5.0.

The mean response score for the item asking students whether they write brief summaries of course readings had a low score of 3.0, indicating that most students did not use this study technique. The remaining items on this sub-scale asked students if they try to connect the information learned in this course to prior knowledge or to other courses had higher scores of 4.2 to 5.0, indicating that many students used these methodologies when studying.

Peer learning sub-scale results.

There were three items on the Peer Learning scale all focusing on whether students worked with classmates to complete assignments or enhance their understanding of course content. Mean response scores for all three items were fairly low on the seven-point scale, ranging from 3.3 to 3.8. These low scores seem to indicate that students did not prefer to work with classmates in order to learn the course material.

Analyses to Determine Relationship Among Motivational Orientations, Learning Strategies, and Course Grade

Two multiple regression analyses were conducted to predict final course grade from students' self-reported motivation and use of learning strategies. One analysis included the six motivation strategies as predictors (intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy and test anxiety), while the second analysis included the seven learning strategies predictors (elaboration, organization, critical thinking, metacognition, environment regulation, effort regulation, and peer learning). For both analyses, the Holms Method was used to correct for Type I error. These two sets of predictors are unordered. The regression equation with the motivation strategies was significant, $R^2 = .14$, adjusted $R^2 = .12$, $F(6, 284) = 7.70$, $p < .001$. The regression equation with the learning strategies was also significant, $R^2 = .13$, adjusted $R^2 = .11$, $F(7, 283) = 6.27$, $p < .001$.

Indices indicating the relative strength of the individual predictors are presented in Table 2. Of the motivation components, extrinsic goal and self-efficacy were positively related to course grade, while test anxiety was negatively related to course grade. Of the learning strategies, elaboration was positively related to course grade and peer learning was negatively related to course grade.

Table 2 The Bivariate and Partial Correlations of the Predictors with Course Grade

Predictors		Correlation between each predictor and course grade	Correlation between each predictor and course grade controlling for all other predictors
Motivation Scales	Intrinsic Goal Orientation	.12	-.03
	Extrinsic Goal Orientation	.22 ***	.19
	Task Value	.09	-.05
	Control of Learning Beliefs	.09	-.04
	Self-Efficacy for Learning and Performance	.30 **	.17
	Test Anxiety	-.18 *	-.16
Learning Strategy Scales	Elaboration	.13 ***	.16
	Organization	.04	-.04
	Critical Thinking	-.07	-.15
	Metacognition	.11	.08
	Time and Study Environment Management	.22	.14
	Effort Regulation	-.03	.02
	Peer Learning	-.19****	-.21

* p <.0125, ** p<.01, *** p<.008, **** p<.007

Next, in order to determine moderating effects of one significant variable on another significant variable, we created five interaction terms. Development of the interaction term was based on both the statistical significance of each variable and conceptual importance. The five interaction terms were created by developing cross-products of the following variable combinations: self-efficacy and peer learning, extrinsic goal and peer learning, extrinsic goal and self-efficacy, extrinsic goal and test anxiety, self-efficacy and test anxiety. Of the five interaction terms, only two were significant.

The first interaction term created by the cross product of self-efficacy and peer learning was significantly related to course grade, $F(3, 287) = 14.09$, $p < .001$. Students who had high self-efficacy who collaborated with their peers were likely to have lower grades. In contrast, students with low self-efficacy who collaborated with peers were more likely to have higher grades.

The second interaction term created by the cross product of extrinsic goal and peer learning was also significantly related to course grade, $F(3,287) = 11.27$, $p < .001$. Students with high extrinsic goal orientation who collaborated with their peers were likely to have lower grades. In contrast, students with low extrinsic goal orientation who collaborated with their peers were likely to have higher grades.

Responses to Questions About Students' Study Habits

In addition to responding to the MSLQ items, students were also asked to respond to two selected-response questions and six open-ended questions focusing on their study habits. Their responses were analyzed by frequency of occurrence. Not all participants answered all of the questions in this section, possibly due to time constraints or simply lack of interest in responding. Because of this, the total number of responses for each question may not equal the total number of participants. Summaries of the responses are provided in Table 3. The responses for each question are listed in rank order of occurrence, beginning with the highest-ranking response. The numbers provided indicate the total responses. The percentages are based on the total number of responses for the particular question. Results of the analyses on the two-selected response questions will be presented first, and will then be followed by the results of the analyses on the six open-ended questions.

Table 3 Summary of Responses to Study Habit Questions

Do you study differently for this class than most of your other classes? (150)	As a student, who do you think is responsible for your success in learning? (150)	What methods do you use to study for this course? (222)	What methods do you use to study for your other courses? (200)	How do you check your understanding of course material? (105)	What is your major strength as a learner? (108)	What is your major weakness as a learner? (77)	What would help you become a better learner? (97)
No 78 (52%)	I am 119 (79%)	Read text and notes 106 (48%)	Read text and notes 115 (57%)	Apply information 32 (30%)	Ability to memorize 26 (24%)	Procrastinate, unmotivated, lazy 33 (43%)	Study schedule 23 (24%)
Yes 72 (48%)	My instructor 12 (8%)	Apply information 51 (23%)	Outline readings 31 (16%)	Quiz myself 29 (28%)	Visual learner 22 (20%)	Low attention span 28 (36%)	Discipline 23 (24%)
	Both 19 (13%)	Use course study guide 31 (10%)	Study with peers 21 (10%)	I don't 16 (15%)	Ability to comprehend and understand 19 (18%)	Lack of time 10 (13%)	Hands-on, real world applications 17 (18%)
		Use flashcards 17 (7%)	Use flashcards 20 (10%)	Make sure it is memorized 10 (10%)	Hands-on learner 18 (17%)	Not good in lectures 6 (8%)	More time 14 (14%)
		Study with peers 9 (4%)	Memorize material 9 (5%)	Discussions with Teaching Assistants 10 (10%)	Persistence and dedication 13 (12%)		Better study skills 11 (11%)
		Highlight text 8 (4%)	Attend class 4 (2%)	Discussions with peers 8 (7%)	Quick learner 10 (9%)		Read more 9 (9%)

Note: Number of responses varies between questions because some participants did not provide responses while others provided multiple responses. Percentages based on total number of responses for each question.

Selected-response Question Results

The first selected-response question asked students if they studied differently for this Computer Literacy course than for their other courses. Students were to respond by circling either "Yes" or "No". Of the 150 participants responding to this question, 78, or 52%, circled "Yes", indicating that they studied differently, and seventy-two, or 48% circled "No", indicating that they studied the same way.

The second question asked students who they thought has responsibility for their success in learning. Students were to respond by circling "I am" or "My instructor is". Again, 150 students responded. The vast majority of the students, 119 or 79%, circled "I am" indicating that they are responsible. A small group of students, 12 or 8%, circled "My instructor" indicating that they feel the instructor is responsible for their success in learning, and 19, or13%, wrote in that both they and the instructor are responsible for their success in learning.

Open-ended Question Results

The first open-ended item in this section asked students to list two ways that they studied for the Computer Literacy course. Reading the text and notes was the most frequently-listed study technique, with 106 responses or 48%, followed by applying information learned in lecture to the lab class, with 51 responses, or 23%. Studying with peers was listed only 9 times, or 4%.

The second open-ended question asked students to list two ways that they studied for their other courses. Again, the most frequently-listed study technique mentioned by students was reading the text and notes, with 115 responses, or 56%. The next most frequently occurring response was outlining readings, listed 31 times, or 15%. Studying with peers was listed 21 times, accounting for 10% of the responses.

The third open-ended question asked students to describe how they check their understanding of the Computer Literacy course material. The responses to this question indicated that there were two methods that most students used to check their understanding. Thirty-two students, or 30%, indicated that applying the lecture information by working on the computer helped them to determine their understanding of the material, 29 students, or 28%, stated that they quizzed themselves, and 16, or 15%, stated that they didn't check their understanding.

The fourth open-ended question asked students what they considered to be their strength as a learner. These results were mixed, with three characteristics being mentioned most often. In total, 108 students responded, with 26 participants, or 24%, indicated their ability to memorize was their strength. Twenty-two students, or 20%, stated that their strength was based on the fact that they were visual learners, and 19 students, or 18%, cited their ability to comprehend and understand.

The fifth open-question asked students what they considered to be their weakness as a learner. Most responses centered around two main themes, procrastination and low attention span. Of the seventy-seven students who responded to this question, 33 students, or 43%, indicating that procrastination, lack of motivation and laziness was their weakness, and 28, or 36% of students indicated that their weakness was due to their low attention span. Ten students, or 13%, indicated that they didn't have enough time to dedicate toward studying.

The final open-ended question asked participants what they thought would help them to become a better learner. From the responses, it appears that there are four factors students felt could possibly influence their learning. Of the 97 students that responded, 23, or 24%, indicated a study schedule would be helpful, and 23 indicated that they needed to be more disciplined. Seventeen students, or 18%, stated that they needed more hands-on, real world applications, and 14 students, or 14%, needed more time in their daily lives to dedicate toward school.

Responses to General Course Questions

Participants were also asked to respond to a series of selected response questions regarding the lowest grade they would be happy with, and how many hours a week they study for this course. They were also asked to respond yes or no to a series of nine items aimed at discovering their reasons for taking this course.

Lowest grade acceptable

Participants were asked to indicate the lowest course grade that would be acceptable to them, A, B, C, D, or E. For each participant, the actual grade earned was then compared to the lowest grade acceptable. Summary of the responses and the comparison between the lowest grade acceptable and actual grade earned are provided in Table 4.

Table 4 Comparison of Lowest Grade Acceptable to Actual Grade Earned

Lowest Grade Acceptable	Participants Indicating This as Lowest Grade Acceptable	Actual Grade Earned by Participants				
		A	B	C	D	E
A	78 (27%)	46 (59%)	23 (29%)	7 (9%)	2 (3%)	-
B	161 (55%)	17 (11%)	85 (53%)	43 (27%)	14 (8%)	2 (1%)
C	51 (18%)	2 (4%)	11 (21%)	25 (49%)	8 (16%)	5 (10%)

N = 290.

All participants wanted to earn a grade higher than C. In total, 156 students, or 54%, earned the grade they indicated would be the lowest grade acceptable, 104 students, or 36%, earned a grade lower than that which was acceptable, and 30 students, or 10%, earned a grade higher than their lowest grade acceptable.

Number of weekly study hours

Participants were also asked how many hours a week they study for this course. They were given five possible choices to select from; 0 hours, 1-3 hours, 4-6 hours, 7-8 hours, and more than 9 hours. Response totals and percentages are provided in Table 5.

Table 5 Reported Number of Study Hours per Week Dedicated to the Computer Literacy Course

Hours per week	Total Responses
0	40 (14%)
1 - 3	206 (71%)
4 - 6	37 (13%)
7-8	5 (2%)
9 or more	2 (1%)

N = 290

In general, 206 students, or 71%, indicated that they dedicated between one to three hours per week studying for this course and 37 students, or 13%, indicated that they dedicated four to six hours per week studying for this course. Forty students, or 14%, responded that they did not study at all for this course.

Reasons for enrolling the Computer Literacy course

The last question in this section of the survey asked students about the reasons they had for taking this course. They were asked to respond yes or no to a series of nine items aimed at discovering their purpose. They were to indicate all reasons that were applicable to them. Response totals and percentages are shown in Table 6.

Table 6 Reasons Students Enrolled in the Computer Literacy Course

Reason	Total Responses
Will be useful to me in other courses	248 (85%)
Required for academic major	233 (80%)
Will improve my academic skills	211 (73%)
Fit into my schedule	212 (73%)
Will improve my career prospects	205 (70%)
Content seems interesting	191 (66%)
Was recommended by my advisor	170 (58%)
Is an easy elective	106 (36%)
Was recommended by a friend	71 (24%)

The responses indicated that most students, 248 or 85%, thought this course would be helpful to them in other courses, and for 233 students, or 80%, this course was a requirement of their academic major. Many students, 211, or 73%, felt the course would improve their academic skills and 205 students, or 70%, felt the course would improve their career prospects. One-hundred ninety-one students, or 66%, took the course because they thought the content seemed interesting.

Discussion

The purpose of this study was to determine the relationship among student self-reports of their academic goal orientation, self-efficacy, self-regulated learning strategy use and their academic performance in a Computer Literacy course as indicated by course grade. Also investigated were students' most preferred and utilized study techniques and the methods they used to monitor their learning in this course.

The results of this study portray a complex combination of the motivation, and learning strategies utilized by college students in a Computer Literacy course. Overall, the results appear to indicate that these students held both extrinsic and intrinsic goal orientations at the same time. For many students, earning a high grade was very important to them, and many took the course because they thought the content would be valuable and interesting. These students also reported that they have both high self-efficacy and low test-anxiety, they utilize elaboration learning strategies and prefer to not study with their peers. Approximately half of the students earned the grade that they indicated was the lowest grade acceptable to them, but about one-third of the students earned a poorer grade than the lowest grade acceptable to them. The majority of students reported that they spent between one and three hours per week studying for this course, however, many indicated that more discipline and a study schedule would help them become better learners

In terms of achievement goals, findings in this study indicated that extrinsic goal orientation was positively related to course grade. This finding is similar to results from a previous study focusing on college students' goal orientations and use of self-regulation strategies in the classroom. In their study, Pintrich & Garcia (1991) found that having an extrinsic goal orientation, such as a commitment to earning high grades, may actually help students focus not only on learning the course material, but also may assist them in maintaining their self-efficacy.

In the current study, self-efficacy was also positively related to course grade. From this finding, it appears that students had a combination of extrinsic goal orientation and high self-efficacy, which may have caused them to persist in their learning of the course material to achieve their desired academic goal. When individuals with either extrinsic or intrinsic goal orientation have high self-efficacy beliefs their behavior is quite similar (Miller, Behrens, Greene, & Newman, 1993). Individuals with high self-efficacy are confident in their ability to succeed at a task, tend to accept the challenge of the task and will persevere in an effort to successfully complete it.

Self-efficacy beliefs also influence the amount of stress and anxiety individuals experience as they engage in a task and the level of accomplishment they realize. In the current study, students reported high self-efficacy beliefs, therefore, it is not surprising that they also indicated they had low-test anxiety. Individuals with a strong sense of competence approach difficult tasks as challenges to be mastered rather than dangers to be avoided. Conversely, individuals with low self-efficacy beliefs may feel that things are tougher than they really are, a belief that fosters stress, depression and a narrow vision of how to solve a problem (Pajares, 1997).

Student selection of learning strategies used to accomplish a task is also dependent on both beliefs of goal orientation and self-efficacy. Results from previous studies have indicated that extrinsically motivated students tend to use short-term and surface-level processing strategies, such as memorizing and rehearsing strategies (Miller, et. al., 1993). Additionally, individuals with performance goals are less concerned with learning, and the use of learning strategies requires effort which implies a lack of ability, an inference that performance oriented students do not wish to make (Ames & Archer, 1988).

In the current study, the learning strategy of elaboration was positively related to course grade. Elaboration learning strategies are generally considered to be utilized by students with intrinsic goal orientations. For students that are intrinsically motivated, their goal is to learn the course material, therefore, learning strategies such as elaboration are often used to enable them to make new information more meaningful by connecting it with prior knowledge (Weinstein & Mayer, 1986). However, results from research by Pintrich and Garcia (1991) found that students with either intrinsic or extrinsic goal orientations both reported substantial use of cognitive and self-regulated learning strategies, such as elaboration and organization. It appears that a high level of concern for grades may actually lead to better cognitive engagement.

From earlier motivational research, it was generally believed that students have either a mastery or performance goal (Meece & Holt, 1993). Yet recent research on the relationship between mastery and performance goals has indicated that these two types of goals are independent of one another rather than opposite of one another. This independence means that it is possible, and perhaps even likely, for students to have both mastery and performance goals at the same time (Pintrich & Garcia, 1991).

Interestingly, results of the current study also indicated that students valued the information they were learning in the Computer Literacy course. Though intrinsic goal orientation was not significantly related to course grade, student responses to the items focusing on their reasons for taking the course indicated that a majority of students enrolled because they thought the course material was interesting. Students that enroll in courses because they find the content interesting or enjoyable are intrinsically motivated. They are taking the course for its inherent satisfaction rather than because it may lead to a separable outcome (Ryan & Deci, 2000). Based on these findings it appears the students in the Computer Literacy course had a combination of intrinsic and extrinsic goal orientations.

Though results of the current study appear to be consistent with the finding of Pintrich & Garcia (1991), it is also important to consider the course context in which the learning strategies were being used. In their responses on the Elaboration sub-scale items on the MSLQ portion of the survey, students in the current study indicated that they used information from lectures and readings to accomplish learning tasks and activities. The Computer Literacy course was comprised of a lecture and lab session, therefore, it is not surprising that students would use information learned in lecture to accomplish lab activities. These results seem to suggest that good strategy use in the classroom may be conditional and contextual to the learning situation, and may not be solely dependent on student goal orientation and self-efficacy beliefs. Future research may be necessary to further clarify these results.

Another characteristic of extrinsically motivated students is their desire to demonstrate their ability, or hide their perceived lack of ability. The fear of appearing incompetent can cause students to use behaviors that they feel might protect their sense of self-worth (Archer, 1994). Results of the current study indicated that peer learning was negatively related to course grade. This result is not surprising since students held high extrinsic goal orientations. A characteristic of many extrinsically motivated students is demonstrating competence to others. Because of this, perhaps these students did not want to appear incapable in front of others. When students pursue goals that concern maintaining a certain image in front of others, they interpret the need for help as a threat to self-worth. (Archer, 1994).

An interesting finding from the current study indicated that students with low self-efficacy beliefs that studied with classmates were likely to have higher grades. Comparatively, students with high self-efficacy that studied with classmates were likely to have lower grades. These results appear to be in contrast to previous research focusing on the effects of goal orientation and help seeking. Results from previous studies, found that students who had low self-efficacy beliefs were more likely to feel threatened when asking their peers for help and were more likely to avoid those types of activities. These students feel that their need for help indicates that they lack ability, therefore, they are less likely to seek assistance (Ryan & Pintrich ,1997; Ryan, Gheen, & Midgley, 1998).

Another interesting finding of the present study also indicated that students with high extrinsic goal orientation that studied with their classmates were likely to earn lower grades. Those students with low extrinsic goal orientation that studied with their classmates were likely to earn higher grades.

Also investigated in this study were the reported study techniques utilized by students in the Computer Literacy course, and what they felt would help them become more successful in their learning. It is interesting to find that approximately half of the students in this study indicated that they study the same way for this course as they do their other courses, and half stated that they study differently. The majority of students indicated that the study strategies they used in the Computer Literacy course were reading their textbook and lecture notes, then applying that information to computer activities. Most students also monitored their understanding of course material while trying to apply this information to the computer activities.

Results from previous research have indicated that use of various learning strategies may be conditional and contextualized. Students, therefore, need to understand the situations when certain learning strategies may be more or less effective (Pintrich & Garcia, 1994). When encountering a learning situation for the first time, students may not know how to think within that discipline. Pintrich (1995) suggests that in order for students to become successful self-regulated learners, teachers should help students become aware of how to think, learn, and reason within the particular discipline. Perhaps this would be beneficial for students in the Computer Literacy courses.

For many students in this course, it appears that learning techniques may need to be improved in order to promote more successful learning. There may possibly be variations to study strategies that could enhance learning in these types of courses. The majority of students indicated that they felt responsible for their success in learning, however, only half of them earned the grade that was the lowest grade acceptable to them, with many others earning a poorer grade. Students also indicated that they believed they could be more successful if they had a study schedule and more discipline. It may be beneficial, therefore, to provide students with appropriate strategies for learning the course material and assisting them in establishing suitable study schedules.

The results of this study highlight the motivation and learning strategies most related to course grade in a Computer Literacy course. This study not only provides information on students' learning goals and their use of self-regulated learning strategies, but it also gives insight to how undergraduate students view learning and the methodologies they use to study. The information provided from this study may assist teachers of undergraduate students in Computer Literacy courses, as well as other computer based courses.

Results of this investigation suggest several avenues for future research. First, measurements in the current study were gathered at only one point in time. It may be useful to replicate this study on a longitudinal basis to further examine the relationships between the motivation and learning strategies that prove to be most effective. Second, it would also be beneficial to look further into the interactions of the significant variables to determine the interplay and influence they may have on student learning and performance. Third, in this study, student self-report measures were used. It would be informative to use other data gathering measures such as interviews and observations. Finally, additional research may be needed to determine how classroom context and structures impact the motivational and learning strategies used by students.

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The Impact of Hypermedia Instructional Materials on Study Self-Regulation in College Students

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Abstract

Does the introduction of hypertext and hypermedia into college instruction impact students' ability to regulate their own learning processes? The metacognition "calibration of comprehension" research paradigm is used to investigate this question. Interviews with experimental subjects provide additional insights into the study process.

Introduction

To be academically successful, college students must effectively allocate study effort among multiple courses based on the requirements of each course. An important study self-regulation skill is the ability to answer the pragmatic question "Do I know this subject matter well enough to take the test?" College students have developed this skill – to varying degrees – through years of studying paper-based textbooks. In today's college environment, Web and CD-ROM instructional materials require students to study materials displayed on a computer screen and organized in a nonlinear structure. Do these nonlinear hypertext and hypermedia instructional materials impact students' ability to accurately assess their own test readiness and thus to effectively regulate their study processes? If so, then the promotion of hypermedia instructional materials in the college environment may create unintended stumbling blocks to academic success.

Literature Review

The research literature to date does not address this issue. Although numerous studies have examined the use of hypertext and hypermedia as instructional media, there is no body of literature addressing impacts of hypermedia on self-regulation of the learning process. Some studies do, however, suggest there may be cause for concern.

Conklin (1987) noted two fundamental issues with hypermedia: disorientation and cognitive overhead. Hypermedia reading requires much greater mental effort in managing the reading process (compared to the simple page-turning of print environments); this mental activity can divert mental resources from the intellectual activity of reading and learning (Dede & Palumbo, 1991). Hypermedia users may lack the navigational skills needed to be successful in hypertext-based learning (Lawless & Kulikowich, 1996; Schroeder & Grabowski, 1995). Domain knowledge of the individual reader is a key determinant of a reader's ability to successful learning in the hypertext environment (Beishuizen et al., 1994; Lawless & Kulikowich, 1996). Reading text from the computer screen generally requires more time (Belmore, 1985; Gould, Alfaro, Finn, Haupt, & Minuto, 1987; Grice, Ridgeway, & See, 1991; Kearsley, 1988). Some experiments have found poorer comprehension with computer-based text (Belmore, 1985; Feldmann & Fish, 1988; Fish & Feldmann, 1987; Reinking & Schreiner, 1985).

Although silent on the question of hypermedia impacts, reading and cognition researchers have investigated learning self-regulation. During the past 15 years, a number of research studies have explored learning self-regulation using a research paradigm known as "calibration of comprehension" (Lin & Zabrucky, 1998). In the current research, the calibration of comprehension paradigm has been adapted to investigate study self-regulation in a hypermedia learning environment.

In a typical calibration experiment, subjects read expository text and then are asked to predict their performance on a simple objective test over the materials read. Actual test performance is compared to self-assessed predicted performance using a correlation coefficient. Subjects able to accurately predict their performance are considered "highly calibrated" regardless of their performance on the test. Likewise, subjects who do not predict their performance accurately are considered "poorly calibrated."

Calibration of comprehension research has shown correlation between predicted performance and actual performance ranging from virtually zero to greater than $\underline{r} = .60$ (Lin & Zabrucky, 1998). Calibration research has also identified several ways in which research designs can maximize the probability of detecting calibration if it is indeed taking place. These guidelines were followed in the current research project:

1. Since posttest performance predictions may be influenced by subjects' prior knowledge of the topic (Glenberg & Epstein, 1987) and by subjects' interest in the topic (Glenberg et al., 1982; Lin et al., 1997), some method of assessing these subject attributes may be useful in the study.
2. Text should be of moderate difficulty for the research subject population (Weaver & Bryant, 1995; Weaver et al., 1995).
3. Posttests should have more than one question per text segment. Weaver (1990) found four questions per text to produce significantly more accurate indications of calibration than a single question per text.
4. Since subjects are better able to inventory their understanding and retention of facts than they are their ability to recognize logical inferences, posttest questions should deal with the recognition of facts and ideas (Glenberg et al., 1987; Pressley et al., 1987).

Experiment

Presentation technology (paper or computer) and content structure (linear or nonlinear) were independent variables in this 2x2 factorial design quantitative study. As illustrated in Figure 1, instructional materials were differentially formatted to create the four experimental treatments. Content was identical in each treatment and consisted of eight topics. The instructional materials (and corresponding test questions) were adapted from a well-established curriculum and test bank.

		Presentation Technology	
		Paper **(P)**	**Computer** **(C)**
Content Structure	**Nonlinear (N)**	**NP Environment** Nonlinear text in paper form (printed nonlinear WWW site).	**NC Environment** Nonlinear text on computer (hypermedia).
	Linear (L)	**LP Environment** Linear text in paper form (book).	**LC Environment** Linear text on computer.

Figure 1. Experimental treatments created by varying presentation technology and content structure.

Experimental subjects (undergraduate students at a small private college) were randomly assigned to the four treatment groups. Each treatment group had 17 subjects. After studying the treatment instructional materials, subjects predicted test performance on each of the eight topics. Upon completion of an objective posttest, a comprehension calibration coefficient (the dependent variable) was calculated for each subject by correlating the eight performance predictions with the actual test scores on the eight topics using the Pearson product-moment correlation.

As noted above, the research literature suggests that subject interest in the study topic, subject expertise in the topic, and subject motivation to perform in the posttest may all be covariates with the calibration coefficient. Length of study time might also reasonably be a covariate. Based on researcher-recorded reading times and subject self-reported measures of interest, expertise, and motivation, no significant covariance was found.

To assess the impact of presentation technology and content structure on subject calibration of comprehension, data generated in the experiments were subjected to hypothesis testing:

1. $H_0$1: There was no significant difference between the calibration coefficients for the computer technology treatment and the paper technology treatment. (Rejection of this hypothesis would mean the presentation technology influences calibration.)
2. $H_0$2: There was no significant difference between the calibration coefficients for linear structure treatment and the nonlinear structure treatment. (Rejection of this hypothesis would mean the linear/nonlinear structure of the instructional materials influences calibration.)
3. $H_0$3: There was no significant interaction effect between the technology and structure treatments as measured by the calibration coefficient. (If hypothesis $H_0$3 were to be rejected, then three more hypotheses would be tested.)
4. $H_0$3a: There was no significant difference between the calibration coefficients for the linear paper treatment and the nonlinear computer treatment. (This hypothesis compared a typical book format to nonlinear computer hypermedia.)
5. $H_0$3b: There was no significant difference between the calibration coefficients for the nonlinear computer treatment and the nonlinear paper treatment. (This hypothesis compared calibration when reading from a website to calibration when reading from a printed copy of the website.)
6. $H_0$3c: There was no significant difference between the calibration coefficients for the nonlinear computer treatment and the linear computer treatment. (This hypothesis compared two different design approaches for hypermedia.)

Experimental Results

The dependent variable, referred to as the "calibration coefficient", was a Pearson Product-Moment Correlation calculated between subjects' self-predicted performance on eight fallacy topics with their actual posttest scores on those topics. The mean value of the calibration coefficient is 0.09 which is significantly greater than zero, $t(67) = 1.95$, $p<0.05$. The median value of the calibration coefficient variable is 0.15. Figure 2 displays the distribution of the calibration coefficient for the experimental subjects.

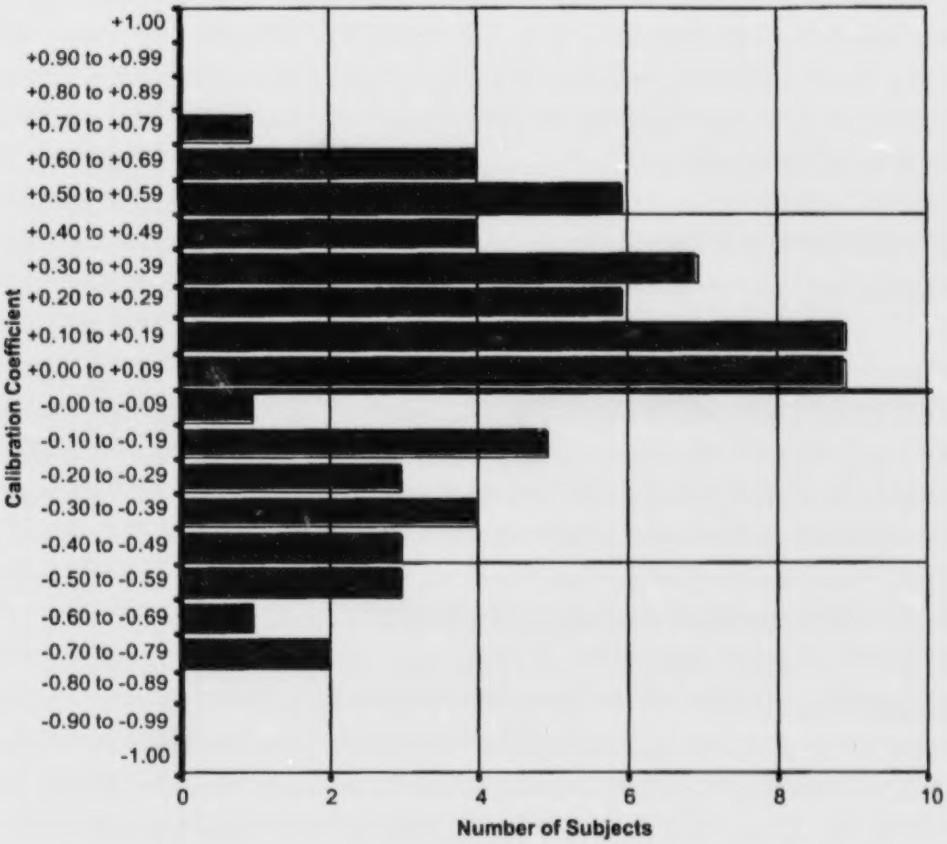

Figure 2. Distribution of dependent variable.

An analysis of variance was conducted to determine if treatments or treatment interactions affected subjects' ability to predict test performance and thus regulate their study processes. As noted in Table 1, treatment effects were not statistically significant nor were there statistically significant interaction effects. Thus, the first three hypotheses are not rejected and the second three hypotheses are not tested.

Table 1. ANOVA with calibration coefficient as dependent variable

Source	SS	df	MS	F
Structure	.176	1	.176	1.251
Technology	.020	1	.020	.146
2-way Interaction	.050	1	.050	.354
Residual	9.005	64	.141	

Post hoc power analysis with $p<0.05$ indicates a power level less than 0.20

Several aspects of the experimental data warranted further investigation:

1. The mean of the calibration coefficients, while statistically greater than zero, was disappointingly low. The 0.9 mean is reminiscent of the earliest calibration research and was expected to be higher since the research meticulously followed guidelines developed in the calibration research literature.
2. The distribution of the calibration coefficient shown in Figure 2 is disturbing. It has the general appearance of a random normal distribution centered on zero and shows a large number of "negatively calibrated" subjects. Negative calibration coefficients imply that subjects consistently score poorly on topics they think they know well and vice versa. Negative correlation is not addressed in the calibration of comprehension literature and has no obvious ties to real world learning

experiences. The negative correlation found in the calibration coefficient distribution suggests a major random process underlying the calibration coefficient.

3. The test questions (along with the instructional texts) have an extensive track record at the host institution. The grade distributions typical for the posttest questions were well known. Posttest scores were lower and more disperse than expected.
4. Reliability analysis and item analysis indicated problems with the test questions. Since extensive past use of the instructional materials and test questions suggest these materials are effective and appropriate together, then low reliability and item analysis scores indicate some other problem in the study methodology.

Taken together, these observations pointed to extensive random guessing by subjects during the posttest phase of the experiment. The randomizing influence of posttest guessing would produce the symptoms noted above.

Interviews

To obtain further insights into the experimental results, two subjects from each of the four treatment groups were selected for interviews. For each treatment group, one subject had a high posttest score and a relatively large positive calibration coefficient. The second subject for each treatment group had a high posttest score and a relatively large negative calibration coefficient. (Only subjects with high posttest scores were selected to make sure the interviewed subjects were actively engaged in the experiment's learning task.)

A thirteen-question telephone interview was conducted with each of the eight identified research subjects. The questions addressed several issues arising from analysis of the experimental data:

1. Effort. Seven of the eight interviewed subjects admitted they would have put much more effort into studying the instructional materials if a course grade had been at stake. Six of the eight subjects estimated guessing at 20%-40% of the posttest questions; one estimated guessing at 60% of the questions.
2. Stopping criteria. Interviewed subjects were ask to describe their study "stopping criteria" - how they decided when to stop studying - for both real world study tasks and for the experimental task. Only three of the eight interviewed subjects used the same criteria in the experiment as they typically used when studying for college courses.
3. Anti-calibration. None of the eight interviewed subjects reported study self-regulation difficulties that resemble anti-calibration.

Based on these interviews, it is clear that subjects were not motivated to study the experimental materials in the same way or to the same extent they study actual academic materials. It can not be assumed then, that the subjects engaged their normal calibration skills either. The extensive guessing during the experimental posttest introduced a large-scale random influence to the experimental data. Thus, it is not clear to what extent the experimental data accurately reflects student calibration in real world settings.

Other Findings

The interviews revealed four types of study stopping criteria:

1. Process criteria. Several subjects described study "rituals" involving reading/re-reading practices, note-taking, or other study strategies. Process-oriented students tended to stop studying once the study process was complete.
2. Feel good criteria. Some subjects reported studying until they felt they knew the materials.
3. Feel bad criteria. Other subjects reported studying until they felt like they weren't getting anything more out of the studying.
4. Time criteria. Some subjects reported studying until they ran out of time and the test was given.

Subjects reported a variety of ergonomic and interface concerns. Eye strain and navigational confusion were mentioned by subjects reading from the computer screen. One subject noted her "body got bored" reading the hypertext – she found the instructional material interesting, but became physically restless having to sit in one position in front of the computer screen. Reading from a book would allow her to change physical positions and read for longer periods of time. Subjects noted they were unable to highlight text on the computer like they did in textbooks. One subject who visualized the book during testing found he could not use the same memory technique when reading from the computer. Two subjects suggested hypermedia would be an excellent tool for reviewing materials already read.

Figure 3 presents one of the most interesting observations from the experimental data. The scattergram shows individual subjects plotted by posttest score performance (x-axis) and predicted performance (y-axis). Regression lines for each of the four treatment groups are shown, along with the R^2 for each regression line.

In examining Figure 3, it is obvious that the LP treatment (the treatment representing traditional studying from a textbook) is noticeably different from the other treatments. The regression line and R^2 for the LP treatment suggests that students who scored better on the posttest were also better able to predict their performance than students who did not mastered the material. This is intuitively appealing, regardless of whether this indicates that better calibrated students learn more or that students who have learned more are better able to assess their knowledge. Note, however, that the other treatments show no such relationship. Since the discussion above has already established that the artificial experimental setting heavily influenced the research data, one cannot presume Figure 3 necessarily represents impacts of the treatments in real world study situations. However, these results do suggest further study is warranted.

Summary

The present study is a pioneering foray into an unexplored issue--the calibration of comprehension in hypermedia environments. In particular, this study was designed to determine if hypermedia instructional materials would impact college students' ability to assess their own readiness for testing.

Two basic characteristics of hypermedia--content structure and presentation technology--were used as variables to define a 2 x 2 experimental design. The content structure variable could be either linear (L) or nonlinear (N); the presentation technology variable could be either paper-based (P) or computer-based (C). The variables define four treatment categories: linear paper-based materials (LP), linear computer-based materials (LC), nonlinear paper-based materials (NP), and nonlinear computer-based materials (NC).

After reading the instructional materials, but before seeing the posttest questions, subjects were asked to predict their test performance on questions for each of the eight topics contained in the instructional materials. The posttest generated eight different scores--one for each of eight topics contained in the experimental materials. For each subject, a Pearson Product-Moment Correlation (Pearson r) was calculated by pairing the eight posttest scores with the eight score predictions. These Pearson r values--called calibration coefficients--served as the dependent variable in the experiment.

Although statistically significant calibration was detected, analysis of variance found no statistically significant treatment or interaction effects. Data analysis and interviews suggest that subjects did not study at the same level of effort or use the same study strategies as used in real-world academic test preparation. This lack of preparation resulted in greater levels of guesswork during the posttest and thus increased randomness in the experimental data. Since students may not have used the same study strategies in the experiment as they use in actual academic coursework, it is not certain whether the findings of the experiment can be applied to actual college coursework environments. However, additional statistical analysis suggests that learning with unfamiliar media may impact calibration of comprehension for some students and that further investigation is needed. Future research seeking to address calibration in academic settings should be incorporated into academic coursework where possible.

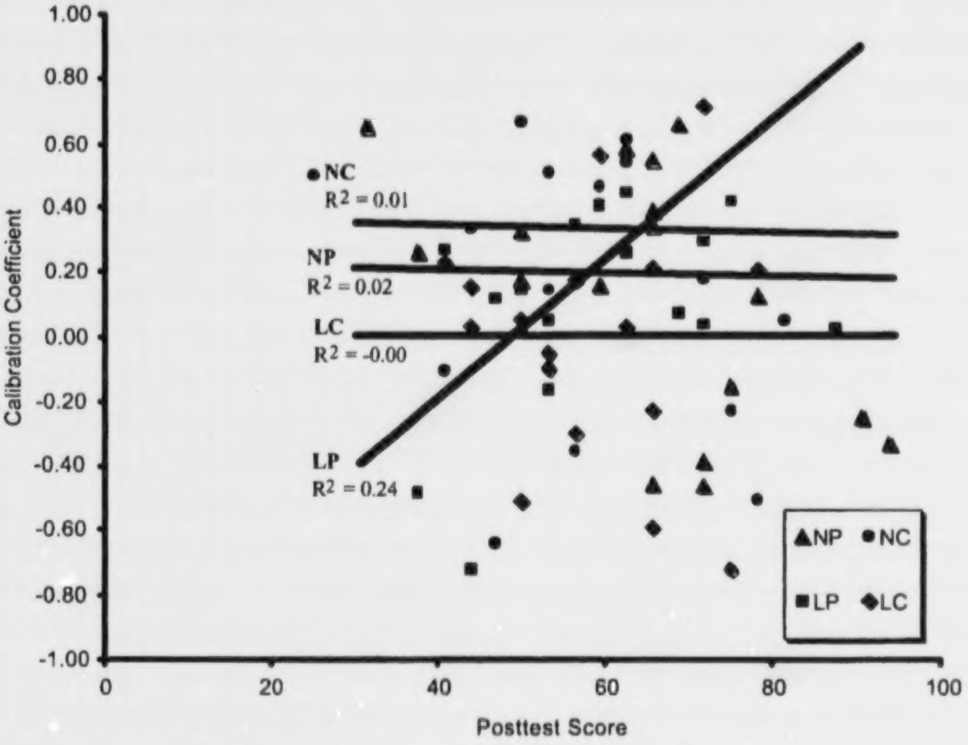

Figure 3. Scattergram of calibration coefficients and posttest scores with regression lines by treatment.

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Learner-Centered Professional Development Environments in Mathematics: The InterMath Experience

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Background

The pedagogical shifts embodied in a series of standards published by the National Council of Teachers of Mathematics (NCTM) emphasize a departure from the teaching and learning approaches typical to American classrooms (NCTM, 1989, 1991, 1995, 2000). National and worldwide assessments such as the TIMSS report (Cochran, 1999 and NAEP (U.S. Department of Education, 2001) confirm that there is a need to carefully examine and improve our educational practices in order to remain a leader in worldwide learning and in worldwide industry. In order to meet the needs of the educational system, we need to rethink the role and format of teacher professional development experiences (e.g., NCSMT, 2000; NPEAT, 2000; National Commission on Teaching & America's Future, 1996; Renyi, 1996; Sparks, 1999).

Several leaders in professional development and mathematics have clearly defined a working plan for improving mathematics teachers' content knowledge and pedagogical content knowledge, as these two factors seem to be critical factors in student learning. Calls for professional development that occurs over a long period of time, that emphasizes teacher thinking and development of reflective dispositions, and that pushes teachers to learn more in their content areas have become pervasive in the professional development literature (e.g., Ball, 1994; Hawley & Valli, 1999; Krajcik, Blumenfeld, Marx, & Soloway, 1994). As pointed out by Kilpatrick, Swafford, and Findell (2001):

> Teachers' professional development should be high quality, sustained, and systematically designed and deployed to help all students develop mathematical proficiency. Schools should support, as a central part of teachers' work, engagement in sustained efforts to improve their mathematics instruction. This support requires the provision of time and resources (p. 12).

This statement is certainly a call for professional development experiences that depart from the "make and take" model that is commonly associated with teacher workshops.

Based on the growing need for constructivist, learner-centered environments (McCombs & Whisler, 1997), National Partnership for Excellence and Accountability in Teaching (NPEAT) has "revisioned" what professional development should look like and be (NPEAT, 2000). Based on current research, and in alignment with other proposals for improving professional development, the NPEAT Research-Based principles provide a guide for professional development. These principles include:

- The content of professional development (PD) focuses on what students are to learn and how to address the different problems students may have in learning the material.
- Professional development should involve teachers in the identification of what they need to learn and in the development of the learning experiences in which they will be involved.
- Most professional development should be organized around collaborative problem solving.
- Professional development should be continuous and on-going, involving follow-up and support for further learning — including support from sources external to the school that can provide necessary resources and new perspectives.
- Professional development should provide opportunities to gain an understanding of the theory underlying the knowledge and skills being learned. (NPEAT, 2000)

In short, teachers should take charge of their learning, be provided with motivational and challenging ways to learn, and should have the opportunity to decide what is most relevant for their students (Hawley & Valli, 1999). NPEAT also asserts that the most successful professional development occurs in a culture of change.

InterMath

One attempt at creating a professional development environment that aims to meet these goals is the InterMath project. InterMath is comprised of a 15-week technology-rich workshop, a website with mathematical investigations and tools to support learning, an ongoing support system that is designed to provide continued support for teachers who have participated in the workshop, and a number of other tools and opportunities to allow teachers to take away what they need for their own success. InterMath was created to help address a critical problem with middle school mathematics – many of the teachers are not knowledgeable enough in their content area or in content pedagogy (SREB, 1998). This is because of the number of middle grades teachers who are either teaching out of field or who have a generalist background. For many subject areas, the generalist degree does not offer a rich-enough content background for the teachers to support students in the classrooms being called for.

The goals of InterMath include the improvement of teachers' mathematical skills and knowledge through open-ended explorations; an understanding and ability to use software to support the development of mathematical thinking; and the creation of a community of teachers who support each other in implementing the explorations-based approach in their classroom. In implementation, there is considerable room for teachers to choose their own path to success – they select which problem(s) they want to work in each of the critical content areas; they select the approach they want to use to solve the problem; and ultimately, the teachers decide the depth of learning they take from the class by choosing to explore more challenging problems, or add extensions to the problems.

It is our view that InterMath provides one approach to learner-centered professional development. We provide the workshop across a full semester, but include tools to allow the continuous growth of an online community. The teachers are given considerable freedom to choose the mathematics that is most relevant to their situation, they are provided with a number of tools from which to select, and they decide what is important in each problem when they prepare their write-ups of their work. While many of the teachers who come to InterMath are not necessarily seeking a reform-based approach to mathematics, they leave with a deepened understanding of the aspects of the NCTM standards that help define a quality mathematics experience. In our interviews with teachers, we have also found that they develop their understanding of learning by experiencing this approach.

This Study

The purpose of this paper is to examine two InterMath pilot workshops and how they were able to meet the goals of learner-centered professional development. We focus on the experiences of the learners, offer insights from each case as well as across cases, and provide suggestions to improve the experience for later learners. The data reported here came only from the workshops and interviews with the teachers and the instructors.

These studies were conducted by participant observer graduate students in each workshop. The observers collected field notes and helped the workshop participants. Another observer (Orrill) visited the larger workshop three times during the course as well. In those visits, the goal was to gain a non-participant view of the learning environment.

Other data collected for this study include tape-recorded interviews with several participants (8 in one class, 4 in the other) and both instructors. There were also informal interviews conducted half-way through the course in the larger group. Student work, published on the Web, was also considered as it provided insight into the teachers' mathematical thinking and technology skills. A survey that asked our participants to discuss the importance of and their comfort with using technology in mathematics was also evaluated.

For the purposes of this study, three weeks of fieldnotes were selected from each class. They came from early in the semester (week 2 or 3), mid-semester (week 6), and later in the semester (week 12-14). All students and instructor interviews were considered. Only the webpages for the interviewed students were analyzed.

The analysis process involved coding and sorting data. We found several emergent categories that came up repeatedly and used those as a framework for our thinking. Those included: Support, Interaction, Barriers, Presentation, and Adoption. Each case is briefly discussed below with a cross-case analysis following.

Case 1

Description

One of the two InterMath pilot workshops took place near Atlanta, GA. Throughout the workshop, approximately 26-28 participants were enrolled. These participants were all full-time middle school teachers in the school district and also University of Georgia graduate students seeking a master's or education specialist degree in middle school mathematics education. Even though the participants were all certified to teach mathematics, some were currently teaching subjects other than math. The teachers participated in the InterMath workshop as their first experience in a middle school program cohort established between their school district and UGA's mathematics education department. While being a member of the cohort was by choice (and acceptance), there was no choice of course selection once the teachers joined the cohort.

The workshop instructor was a full-time professor in the mathematics education department at the University of Georgia and also one of the InterMath developers. There were two mathematics education graduate assistants who served as participant observers during the workshop. The project manager, who visited the class three times during the semester to act as an outside observer, also made additional observations.

The workshop took place at the county's board office computer lab. There were approximately 29 computers in the lab. The computers lined three walls of the room to form a U-shape. In the middle of the lab, there were six long tables that faced an overhead projector screen in the front of the room. There were no computers at these middle tables. The participants themselves chose to sit at the long tables, rather than at the computers during the lecture portion of each class period. On the first table, the instructor set up a laptop computer to connect to the projector. He faced the participants, who sat in the latter five rows, as he taught. No students ever sat in the front row.

The class met weekly in the evening. During the first hour portion of each class, the instructor taught in a traditional lecture-style manner. He demonstrated how to explore InterMath problems using software such as Geometer's Sketchpad, NuCalc, and Excel. The instructor asked a few questions during his demonstrations, but there was little student involvement. The class would then shift to the computers to work on problems, write-ups, and webpages. For the remainder of the class, the participants explored the investigations using various software programs and wrote up their findings to post to their individual web pages. The instructor and graduate assistants walked around the room to assist the participants with technological and mathematical questions, as they requested help.

In our analysis of data, we found the following trends in this setting.

- Over-reliance on the instructor

The participants seemed to perceive the instructor and graduate assistants as experts. They relied on the instructor, rather than each other for technological and mathematical support. Moreover, they seemed to view the main instructor as the "owner" of the class. Even after seeking help from the graduate assistants, the participants often wanted the instructor's approval. For example, one participant was exploring an investigation where he needed to find the maximum volume for a box. The participant asked one of the graduate assistants how he could incorporate technology in the investigation. More specifically, he wanted to know what technology he could use. The graduate assistant discussed some of his options. Instead of exploring these routes on his own and finding multiple representations of the problem, the participant told the graduate assistant that he was going to ask the instructor which way he should explore the investigation. The participant was seeking a "correct process" for solving the investigation from the instructor. He only wanted to explore the problem the way the instructor/ "owner" saw it.

The instructor seemed to put himself in the ownership role through the manner in which he structured the class. He directed the workshop conversations and selected which problems to investigate. He sought little input from the participants about exploring the problems he had chosen. The participants were placed in a passive role during the first half of the workshop. In the observations, many were reported as off-task during the lecture/demonstration portion of the workshop. During the second portion of each meeting, participants chose to work individually on their write-ups with little communication with other participants. Yet, in the interviews, the participants relayed the feeling that there was not enough support available during the workshop. This feeling further illustrates the assertion that the participants did not turn to each other for support, but rather saw the instructors as their only source of support. In observations, the second half of the workshop was described as being very quiet other than the sound of clicking and the graduate assistants talking to the participants. We would have liked to have seen more interaction and collaboration among the students during the entire class period.

- View of InterMath

The data distinguished three categories of the participants' views of the goals and purposes of InterMath. In the first category, participants saw InterMath as a "make and take" activity to take into their middle school mathematics classrooms. They selected investigations for their own use based on the knowledge level of their students, rather than their own knowledge level. Because of this, the participants failed to push themselves to increase their own mathematical understandings. These participants had the misconception that InterMath was for their middle school students, rather than a challenge for themselves personally. This idea influenced problem selection and depth of exploration of a problem, which was evidenced in some of the workshop discussions and by the participants' webpages. In one class, a participant voiced the concern that the investigations seemed very hard for middle school students. The instructor explained that the investigations were meant for the teachers and that the teachers would have to adapt them if they chose to use them with middle school students. Despite this explanation, participants continued to cling to the idea that the investigations were suitable for their middle school students with little modification or thought into how to present such an activity to this age level.

A second group seemed to view InterMath as technology. They wanted to learn how to use the software tools, but took little interest in using the tools to develop mathematical understandings. In workshop observations, these participants became excited when using the technology and learning something new on the computer. However, very little of their focus was placed on learning new mathematical concepts and making connections. For example, during a one of the workshop classes, one of the graduate assistants showed a participant which button to push to display all the Excel functions she might have needed to create a spreadsheet. The participant said something to the nature of "woo-hoo! I'm finally excited about something in here!" This participant apparently wanted the InterMath workshop to teach her to use the technology more efficiently, rather than using it to deepen her understanding of mathematics.

The last group saw InterMath as an opportunity to enhance their mathematical understandings. In the interviews, these participants stressed the learning of mathematics over the learning of the technology. Unfortunately, few participants held this view of InterMath. One explanation may be that the participants seemed to have a low mathematical knowledge base. The participants particularly seemed to experience difficulties in the discipline of geometry and thus had trouble making mathematical connections and multiple representations that were crucial in the investigations. However, these were the students who seemed most interested in further exploration of the mathematics and also the most reflective about their own mathematical ability.

- InterMath adoption to the classroom

Some of the participants had already begun to use InterMath in their classroom before the end of the workshop. Surprisingly, there seemed to be little or no adaptation of the InterMath investigations when the teachers took them into the middle school classroom, as evidenced in workshop observation discussions. This is ironic since a number of teachers mentioned in class that they felt like the InterMath investigations were not appropriate for the middle school level. Late in the semester, one of the participants pulled one of the graduate assistants to the side and shared with her what she had been doing in her middle school classroom. She had assigned her students to choose three InterMath investigations directly from the website to work on and to write-up in two weeks. Apparently, the participant made no modifications on the investigations for her middle school students. Even more, the participant seemed to make no attempt to guide the students as to which investigations they might attempt. The teacher made no reference to having her middle school students work in cooperative groups, but rather asked that each student turn in their own independent write-up.

The manner in which some of the participants incorporated InterMath into their classrooms is not surprising considering how many participants viewed InterMath as a mathematical development tool for middle school students, but not for themselves. In addition, instructing the middle school students to work independently parallels the way the participants themselves worked through the investigations during the workshop. Many of the investigations were not meant for middle school students, but rather to challenge the middle school teachers' own conceptions of mathematics and how it is taught.

In the post-workshop surveys, most of the participants perceived an increase in their ability to incorporate technology and mathematics in the classroom. However, interviews reveal that the participants felt a need for more pedagogical support in taking InterMath into the classroom.

Case 2

Overview

The UGA pilot of the InterMath workshop was held at a center designed for supporting teacher professional development with technology on the University of Georgia campus. The classroom was made up of four rows of two tables that all faced an overhead screen. Each table held four computers, and an instructor's workstation sat at the back of the room. The workshop met one evening per week during the Spring, 2001 semester.

The class began with seven students; however, by the end of the fifteen weeks, there were only four participants in regular attendance. Two of these participants taught eighth grade pre-algebra and algebra at a rural middle school. The other two participants came from a private middle school; one was a sixth grade mathematics teacher and the other was the technology support person who also had a mathematics education background.

A professor from the mathematics department at the University of Georgia led the workshop, and two graduate assistants, one from UGA's mathematics education department and one from the instructional technology department, attended regularly in order to assist the instructor and participants and to collect research data. A third graduate assistant, also from the instructional technology department, attended the first few workshops and supported the participants in learning web publishing.

What the participants DID learn

There were some overarching successes in this pilot. First, the participants learned how to use technology to create and post write-ups of their mathematical investigations. Specifically, the participants learned how to use computer software that included web composers and FTP clients. On average, the participants posted seven write-ups to the internet. These write-ups often included links to spreadsheets and/or dynamic geometry files.

Second, the participants learned to identify and to appreciate certain aspects of reform-based issues in mathematics teaching and learning. As evidenced through their final interviews, the participants noted the value of problem solving, learning through collaboration and communication, finding multiple solutions and answers, and asking extension questions. For example, when asked what students in an ideal mathematics classroom would be doing, one participant commented, "Well, after all this, problem solving." Anther participant said that an ideal classroom to her would be one in which the students are "asking questions and they're showing their classmates what's happening and sharing ideas and thoughts and communicating with each other." A third participant mentioned that the most important things she learned from the InterMath experience were "The importance of thinking and not just computation. ... And collaboration." She also stated, "I've even told my kids that there are lots of ways to find an answer and oftentimes the answer's not the important part." It was clear that mathematics and mathematics education pedagogy were key issues to these participants.

What the participants DID NOT learn

There were also some critical areas in which learning did not occur as expected. Improvement in these areas is a focus in preparing for the next InterMath workshop. First, the participants did not seem to greatly expand their mathematics content knowledge. Approximately 61% of the write-ups posted were about investigations that were taken from the Algebra or Number Concepts units on the InterMath website. These units correspond to the majority of the topics that are covered in middle grades mathematics. Only 25% of the write-ups focused on Geometry problems and only 7% on Data Analysis problems. One participant mentioned that after she and her partner struggled with a problem that was hard, they would simply "close that one up, and we'd do another one." Issues of lack of perseverance and an unwillingness to try new areas, possibly relating to efficacy, were prevalent.

Second, the participants did not become comfortable with using a variety of mathematical software in doing their investigations. Approximately 86% of write-ups indicated that the authors used spreadsheets to help them with the investigations. Not surprisingly, spreadsheets were the only software the teachers had considerable experience with when they began the workshop. Only 18% of write-ups illustrated use of geometry software, and only 4% mentioned the use of graphing software. One participant stated that she and her partner "felt more comfortable using a spreadsheet. And it's just because...that's what we could maneuver better with."

Finally, the participants did not mention any form of proof in their write-ups (it should be noted, however, that the instructor did not emphasize the importance of including proofs in the write-ups). Most of the participants used numeric patterns or measurements to justify their solutions to the investigations. No one offered any conceptual explanations or tried to rationalize why the numeric patterns or measurements must have given the correct answer. More disturbing, they also did not seek to use extensions to push their thinking and/or their students' thinking further, even though that issue was an explicit focus of the instructor. The instructor commented that even when the participants did write extensions, they never tried to solve them. This fact may relate to the same issues that prevented attempts at difficult problems.

Cross-Case Analysis

Several findings emerged that spanned across both cases. There were also some findings within each case that we were unable to reconcile. For example, we are not sure why we lost three of seven students in Case 2. While they reported they each left for personal reasons, the fact that all three were from one school raises questions about how to keep busy teachers engaged in the experience. We can speculate about the role of groups, the need for proper location, etc.; however, there is no clear way to determine whether that trend is one we need to attend to in future cases.

For our cross-case analysis, we adhered to the findings framework introduced previously. We looked at what we found in each case, what was true in both cases, and what we thought might be a reasonable assertion based on the evidence provided.

Support & Interaction

We found that support and interaction became very intertwined in our cross-case analysis. This fact was because most of the interactions between students and between instructors and students were focused on helping the learners be successful in what they were doing. We noted that there were two distinct kinds of interactions: affective (those aimed at providing positive feedback or other information to keep the students motivated) and intellectual (those interactions that provided the information learners needed in order to move on with the problem on which they were working). Based on our interviews and observations, the affective interactions were particularly important between participants. Several times the learners commented that they felt behind or inadequate until they began talking with the other participants or until they began to find out from the support staff that others were having the same kinds of problems. In more than one case, this "same boat" effect prevented our participants from dropping out of the workshop.

Another support/interaction issue that appeared was the overwhelming number of procedural questions that were asked by the participants. In both workshops, until around the middle of the semester, the questions all focused on how to use particular pieces of software. Later, we saw some movement to more process-oriented thinking, but the procedural questions never faded entirely. This finding raises a number of questions about supporting the teachers in getting the learning that we had hoped for from the workshop and about who needs to provide support and what that support should look like. In Case 1, we had about 30 students with three support people (two graduate assistants and one instructor) in Case 2, we had one instructor, one to two graduate assistants, and another graduate assistant who acted primarily as a researcher, but ended with only four students. Even with, or perhaps because of, this presence of knowledgeable others, the teachers resisted engaging with each other for problem solving, instead turning to those perceived as owning information. This phenomenon leaves an open question about whether the students perceived that InterMath allowed them to understand the theory and skills they were learning – after all, if they still felt they needed to seek instructor guidance rather than relying on themselves or their peers, it is likely that they still held the traditional idea that math is about right answers and that the teacher's role is to have those answers.

Finally, while we provided every opportunity for collaborative learning, few teachers chose to engage in it. Even in those instances where teachers worked as pairs or trios, they tended to each work their own problem and rely on each other only when they were confused or unable to continue. We also found that among the teachers who did work together, almost every group included teachers who worked together in the same schools. These findings combined lead to two insights: first, teachers seem to work with people who they already know and feel safe with; second, teachers are not naturally predisposed to working in groups. This second point may explain many teachers' reluctance to include groupwork in their classrooms– which reinforces the need for the professional development environment to model the desired classroom environment.

Barriers & Difficulties

There were two main barriers across the two cases: technology and goals. The technology problem was one of both participant inexperience with the tools we were using and hardware problems that were exasperated by participant inexperience with the tools. The technology difficulties were so severe that almost half of each workshop was spent with students struggling to make webpages and publish them. This amount of time was particularly alarming given that the webpage aspect of the class was only a tool for portfolio generation. The technologies that were of greatest interest were tools that allowed mathematical visualization and exploration (e.g., Geometer's Sketchpad, Excel, and NuCalc/Graphing Calculator). Further, the web development goal was a tiny one as compared to the mathematical aims of the InterMath experience.

The barrier caused by goals was an interesting one. The problem was that the participant goals and the workshop goals were not always in alignment. In our follow-up interviews and surveys, for instance, a large number of teachers indicated that learning technology was their perceived goal for InterMath. Those who reported this, it should be noted, were also quite happy with their experience. However, that was not our intended goal. What we had hoped was to allow teachers to think about teaching and learning mathematics in a different way – certainly technology was a part of that vision, but not the central component.

Another large group of teachers seemed to think that the InterMath workshop provided an opportunity to become familiar with a tool, the InterMath website, that could be used in middle-grades classrooms. While there were some problems that certainly could be useful for middle school students, the purpose and intention of the site was to enhance teacher mathematical understanding.

Because teachers saw the site as being a tool for use in their own classrooms, many completed only problems they felt their students could complete. This meant that many of them did not challenge their own mathematical abilities at all.

On one hand, because the participants were able to define and follow their own goals, they were pleased with the outcome. On the other hand, we have concerns about the kind and quality of learning given that teachers did not seem concerned with their mathematical development.

Adoption

Our final major finding in the cross-case analysis was a disturbing trend among the teachers who implemented the InterMath problems in their classroom to structure their students' learning experiences exactly as their workshop experience had been structured. This was alarming for a number of reasons. First, it demonstrated little reflection on the part of the teachers about their students' abilities in mathematics. They allowed students to randomly choose problems from sets that covered a number of topics and varied in conceptual difficulty tremendously. Further, the teacher participants had complained throughout the workshop, in both cases, that there was not enough structuring because there were not clear guidelines for assignments, etc. Yet, they reported implementing this same kind of approach for their students who did not have the maturity or life-experience upon which to draw to cope in this extremely open-ended environment. In short, it seemed that the teachers borrowed InterMath rather than adopting it. It may be argued that this is the first step of adoption, but it is complicated because we no longer have the opportunity to support these teachers in their efforts.

Further, post survey results indicated that the teachers were not yet comfortable with the implementation. This was perhaps corroborated by the teachers who talked about using demonstration techniques to implement InterMath in their classrooms or those who said they needed more practice themselves before they could implement. While these problems are somewhat different from the wholesale adoption approach with no attention to philosophy, they still prevent the students from having a successful experience with mathematical explorations.

Conclusion

In conclusion, we offer our suggestions for improvement for this kind of workshop experience.

First, it is vital to the success of the workshop that we solve the technology problem. Unless we find a way to shift teacher focus away from the procedural aspects of using the technology, we will not be able to support them in their content knowledge development. While the learner-centered professional development principles do indicate that teachers should be in charge of setting their goals, it seems critical that the learning of procedure needs to somehow be removed from the prominent position it held in our pilot workshops. Some ways of supporting teachers in the technology area might include setting prerequisites for taking the workshop, creating a forms-driven webpage publishing approach, or rethinking the role of online portfolios in the InterMath experience. We could also provide special technology skills workshops for the participants. From a more systemic view, it seems that schools need to support a higher level of technology literacy among their teachers. All of our participants had completed some kind of basic technology training, yet they did not know how to accomplish their goals either conceptually or procedurally.

For the goal alignment problem there are several potential solutions. First, consistent with the NPEAT standards, more professional development opportunities should be aimed at supporting teacher conceptual development rather than activity generation. Further, we learned that simply telling the participants about the intentions of the workshop was not enough. They need to be challenged through the structuring of the workshop to push themselves. Further, they need to have the opportunity not only to own the goals they are aiming for, but also to own the workshop itself. Participants need to feel that they can work with the instructor(s) to steer the professional development program for their success. Finally, we need to look for ways to let the need for technology arise out of the mathematics so that the teachers first explore what mathematics and mathematical knowledge are, then look for ways to solve the problems. The technology should be one of a host of tools that they are comfortable with and able to use in the learning environment.

Finally, the adoption issue. From our experience in these two classes, it seems reasonable that a first step toward more meaningful adoption by the teachers would be to attack the problem head on – to discuss ways to implement InterMath with the teachers, to look at ways problems might be modified to more appropriately meet the needs of middle school students, and to discuss the value and learning that might come from using the investigations. A second approach might be to model a classroom approach to using the problems with the students. In this way, we would provide a safe environment in which teachers can think through the issues involved with implementation before affecting students. Finally, our ongoing goal of creating a lesson plan database may help with the adoption process. The database will provide InterMath participants with access to tested lesson plans that other teachers have used in their own classrooms.

In conclusion, InterMath offers one view of a research-based professional development endeavor. In our initial implementation we learned much about the successes and pitfalls of working within this kind of framework.

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Cost-Benefit Analysis:
Case study of the Distance Master of Science Program in the Department of Instructional Systems Technology, Indiana University

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Abstract

The Instructional Systems Technology Distance Master of Science program is one of the first degrees of its kind to be offered at Indiana University. Other than an initial on-campus orientation, it can be completed entirely via the Internet. The first course for this program was offered Fall of 2000 with eighteen students enrolled. This same semester, a research team analyzed the monetary costs and pecuniary benefits of this program in a cost-benefit analysis. They identified the costs and benefits from the perspective of the department. Using these, they calculated the costs to benefits ratio. Although the team concluded that the distance program had a high costs to benefits ratio, there are many value benefits which were not monetarily included in the analysis. This report also offers recommendations for further cost-benefit analyses of a distance education program.

Introduction

For Fall semester 2000 the Instructional Systems Technology (IST) department in the School of Education at Indiana University established an online Distance Master of Science (DM) program. It was designed and developed to mirror the on-campus IST Master of Science program.

As part of the on-campus course *R563: Business and Economics of Training and Development*, a team of six students conducted a cost-benefit analysis (CBA) for the DM program in the Fall of 2000. Literature shows that most studies of online learning environments have been conducted to examine educational advantages and to explore effective design strategies (Jung & Rha, 2000). In contrast, the R563 team, working with Dr. Charles Reigeluth, Director of the DM program, focused their analysis on the monetary costs and benefits to the IST department and/or the School of Education. For simplicity, these will be referred to as "the IST department" or "the department."

By presenting a breakdown of the developmental and ongoing costs and benefits, this report provides information from which the IST department could base future DM program decisions. This report may also be useful for others who are responsible for the design, development, implementation, and maintenance of distance education programs in higher education.

Literature Review

Distance Education

According to Molenda (1996), "distance education refers to a program of some duration, leading to formal recognition of achievement, in which the learner is separated from the instructor and in which special arrangements have been made to facilitate dialog between the remote students and an instructor." Keegan's (1980) definition of distance education is still widely used today. He defines the principle characteristics of distance education as the separation of teacher and learner; influence of an educational organization; use of technical media; provision for two-way communication; and possibility of occasional meetings.

In general, educators believe that distance education is subject to economies of scale and that the primary benefit of this form of education is that costs can be distributed over a large number of students. It is seen as a probable money-making venture because of the greater number of students who could potentially enroll versus traditional on-campus programs. The higher the revenue overall, the lower the cost per student would be (Inglis, 1999; Whalen & Wright, 1999). While this potential to exploit economies of scale exists in distance education, it does not mean that only programs with high student enrollment can be cost beneficial (Curran, 1995).

Cost-Benefit Analysis

When conducting a cost-benefit analysis, dollar amounts are examined for both the costs and benefits. The costs are then compared to the benefits in a costs to benefits ratio. This allows one to determine the extent to which the monetary value of a program's benefits outweigh the costs (Sikorski et al, 1991). If the decision were purely economical, a program would exist only if the costs to benefits ratio were less than one, meaning, monetarily, benefits have exceeded the costs.

An advantage of cost-benefit analyses is that programs can be directly compared no matter what their platform, desired outcomes, values, and delivery systems are. Everything is converted to monetary values and thus can be directly compared.

The primary disadvantage of a cost-benefit analysis is that oftentimes it is difficult, if not impossible, to account for every foreseeable cost and benefit in monetary amounts (Levin, 2000). This is especially true for certain value-based benefits, which are often left out of a CBA (Cukier, 1997). For this reason, it is important to consider other cost-analyses, such as cost-effectiveness, cost-utility, and cost-feasibility when deciding whether or not to pursue a particular program.

Measuring Costs

As part of a study conducted at Marshall University, Morgan (2000) divided costs into categories to help determine the cost of online courses. Based on this study, three main cost categories emerge:

1. *Capital and recurrent costs*: These occur on an ongoing basis, such as technology support, equipment upgrades, indirect costs, and course maintenance.
2. *Production costs*: These are incurred during the development of courses, including factors like providing software to students.
3. *Delivery costs:* These costs are associated with teaching a course, such as instructor salary, course-related mailings to students, and opportunity costs related to teaching a course instead of doing an alternative.

These costs can be broken down even further to include hidden costs, technology specific costs, support personnel costs, faculty training costs, and/or administrative costs (Morgan, 2000).

Whalen and Wright (1999) compared the capital, production, and delivery costs of online courses with the costs of equivalent courses taught in the classroom. They made the assumption that the learning outcomes were the same. Their capital costs included the cost of the server which housed all courses. They divided production costs into six areas: instructional and multimedia design costs; the cost of producing text, audio, video, graphics, and photographs; the costs of authoring and delivering software, or the cost of licensing and delivering commercial software; the costs of testing and modifying course content; student and instructor training costs; and final course testing costs.

For their analysis, they also divided their costs into fixed and variable costs. They defined fixed costs as costs that remain the same regardless of the output and variable costs as those that vary directly with the amount of output—so fixed costs are the same no matter how many students are in a course, while variable costs increase with the number of students.

They determined that online courses tend to have higher fixed costs than classroom-based courses, but that these costs are offset by lower variable costs. Due to the reduction in course delivery time and the potential to deliver courses to a larger number of students, they found online courses to be more cost-beneficial than classroom teaching.

Whalen and Wright chose to ignore costs that would have been incurred had a course been delivered in a classroom (sunk costs) in their analysis on online courses. They identified these costs as instructor salary and benefits, equivalent costs of course development, course materials, administrative support, and classroom overhead.

After gathering cost information for both online and traditional courses, Whalen and Wright used costs to benefits ratio analyses to determine the breakeven number of students required to recover costs over five years.

In a similar study, Bartolic-Zlomislic and Brett (1999) analyzed costs and benefits of an online graduate course at the University of Toronto. Their analysis projected that the online course would likely make a profit of 1,962 Canadian dollars per year. They also calculated that 19 students would be needed to achieve a breakeven point.

Measuring Benefits

When he estimated monetary value, Cukier (1997) divided benefits into three categories:

1. *Performance-driven benefits*: These include cost savings, revenues, and other income. These benefits are usually the easiest to quantify and thus lend themselves easily to a cost-benefit analysis.
2. *Value-driven benefits*: From a departmental perspective, these may include time efficiency, flexibility, consistency in quality of delivery, ease of access to the technology, the quality of student-teacher interaction, the rate and ease by which material can be updated and changed, the appearance of being at the cutting edge of technology, opportunities for on-campus students to produce the online course, and expansive delivery with limited interaction.
3. *Value-added, societal, or indirect benefits:* These include reduction in capital investments (fewer buildings and parking lots), reduction in pollution, increased job creation, new business opportunities (telephone companies, publishers), reductions in social community costs, the creation of secondary markets, time savings, revitalizing a curriculum and faculty, reaching new markets, and increasing student diversity.

An organization may adopt a value-based approach to a CBA to stress the importance of understanding the pedagogical needs and values when judgments are made about costs and benefits. The main strength of a value-based approach is that it allows for a subjective definition of benefits, therefore making it a flexible technique (Cukier, 1997). Such an organization may decide that a program which may have a high costs to benefits ratio is still worth pursuing because of the value it offers.

All benefits, as well as costs, are determined on a program by program basis as each organization has differing pedagogical needs and values. For example, one possible value-driven benefit for an online program might be expansive delivery with limited interaction. However, for another organization which values interaction, this would be viewed as a cost.

Measurement

The data were collected from four separate sources:

1. *Cohort Study:* Data concerning faculty salaries were taken from the Cohort Study located in the Dean of Faculties at Indiana University.
2. *Questionnaire:* General data regarding the use and opinions of the DM program were gathered using a survey questionnaire. It was distributed to and filled out by several faculty members, staff members, and graduate assistants who were directly involved in the program.
3. *Personal Interviews:* From the respondents of the questionnaire, the team selected individuals to be interviewed. They were: Dr. Charles Reigeluth, Director of the DM program; Dr. Robert Appelman, Head of Technical Support; Prof Elizabeth Boling, IST department Chairperson; Carthel Everett, Contract and Grants Specialist in the School of Education; Susie Sloffer, DM program graduate assistant; and Bill Dueber, technical support graduate assistant. These interviews focused more specifically on costs and benefits regarding the DM program.
4. *Online Resources:* Websites on various distance education programs at Indiana University and at other institutions added to the general knowledge and understanding of costing a distance education program. Of these, the most beneficial was Morgan's (2000) study.

Methodology

Gathering Cost Data

Based upon Morgan's (2000) study, the team gathered cost information for the first academic year of the DM program and placed it into the three categories:

1. *Capital and recurrent costs*: Server, server administration, data communications charges, maintenance, equipment, technological support, and indirect costs.
2. *Production costs*: Faculty training for online course tools, course development, course materials, and licensing software.
3. *Delivery costs:* Instructor salary and fringe benefits, director salary, graduate assistant support, adjunct instructor wages, and opportunity costs.

Gathering Benefit Data

The team organized the benefits for the first academic year of the DM program based on Cukier's (1997) benefit categories:

1. *Performance-driven benefits*: Funding for development, student tuition, and technology fees.
2. *Value-driven benefits*: Time efficiency, flexibility, ease of access to the technology, the rate and ease by which material can be updated and changed, the appearance of being at the "cutting edge" of technology, opportunities for on-campus students to produce the online course, and expansive course delivery to capitalize on economies of scale.
3. *Value-added, societal, or indirect benefits:* Reduction in capital investments, increased job creation, time savings, revitalizing a curriculum and faculty, reaching new markets, and increasing student diversity.

Results

Costs and Benefits

The results of the data are summarized as follows (see Appendix A for the detailed breakdown):

ACTUAL COSTS AND BENEFITS	TOTALS
Benefits	$91,606.40
Less: Costs	$177,159.41
NET	($85,553.01)

Using the cost and benefit data, the team calculated the costs to benefits ratio.

Costs to Benefits Ratio

Costs	$177,159.41
Benefits	$91,606.40
Ratio	1.93

This ratio shows that costs for the DM program are nearly twice the monetary benefits.

Discussion

DM Program Costs to IST

It is clear that the IST DM program is not a money making venture. But, it must be remembered and emphasized that this program was not launched nor was ever intended to be a profit producing entity. The motivation behind the DM program was, quite simply, to investigate the possibilities of offering an online program that would mirror the experience of the on-campus Master of Science program. Because of the current staffing situation and the labor-intensive nature of delivering an equivalent online degree, the enrollment has been capped at 20 students p er course.

The team was able to approximate the indirect costs using percentage breakdowns provided by the School of Education. This data was then inserted into the cost calculation model from Marshall University. Some of the categories from Dr. Morgan's model did not apply to the IST DM program. For instance, the IST DM program was given the go-ahead from the School of Education on July 1, 2000 to begin in the Fall 2000 semester. The department had approximately one month to prepare the coursework. Thus, the IST DM program generated revenue in the first year. Dr. Morgan's model devotes the first year of a distance education program strictly to development with no student enrollment. Therefore, there were no monetary figures for performance-driven benefits.

Dr. Morgan's model also calls for costs of technology investment. However, the IST DM program had, and has, an extensive existing infrastructure within the School of Education and Indiana University. Because of this, the department did not have to purchase any extra equipment, including servers. There is also existing technology support that is provided for by the indirect costs. In their interviews, professors indicated that, in the near future, there will need to be an investment into technology support and maintenance for the DM program to continue. These are costs that will need to be considered in the future.

In this analysis, the team did not factor in opportunity costs. The Department has not assigned monetary values to the cost (or perhaps benefit) of not pursuing other teaching opportunities instead of the DM program. According to some survey responses, it takes roughly twice the time to prepare for and teach a DM course during this first year. The university currently pays the instructor the same amount for teaching an online course as it would for an on-campus course. The underlying assumption is that the time commitment for a distance education course is no greater than an on-campus course. This additional time could be spent mentoring students, serving on dissertation committees, conducting research, and publishing.

DM Program Benefits to IST

Of the three categories of benefits that the team used, only the performance-driven benefits had a specific dollar amount identified by the department. Value-driven and value-added benefits are not necessarily tangible, and thus more difficult to assign a monetary value. This does not mean these benefits are less important. To the contrary, value-based benefits may be the most important benefits in a distance education program. Moreover, depending on the pecuniary values assigned to value benefits, the total benefits may far outweigh the total costs. It is possible that this is the case in the IST DM program.

Performance-driven benefits:
- *Revenue generated:* Tuition, DM fees, and the startup money.

Value-driven benefits:
- *Institutional prestige*: By having a distance education program, the reputation of Indiana University, the School of Education, and the Instructional Systems Technology department as being on the cutting edge of research and technology is fortified.
- *Learning and applying opportunities*: Students in the on-campus program have opportunities to assist in producing the courses for the DM program. This provides the on-campus students with an opportunity to apply the skills they have learned by producing authentic online courses.
- *Publication possibilities*: The IST DM program provides numerous possibilities for faculty and students to conduct research that may lead to publication.
- *Anytime and anywhere*: Students in the DM program can complete their assignments when it is convenient for their schedules. The flexibility offered with distance education is not possible in an on-campus course.

Societal or value-added benefits:
- *Increased student diversity*: The DM program offers students that have career, family, or geographic constraints the opportunity to obtain a degree from the IST department. These students may have no other way of obtaining this degree.

- *New job creation*: With the DM program in place, two extra Graduate Assistant positions were created to help handle the extra workload. These positions would not exist without the DM program. Having these extra positions available may attract students who might otherwise attend a different institution.
- *Potential to revitalize the faculty and/or curriculum*: Having a distance education program can be a new source of motivation for faculty and staff members of a department. It can be seen as something new and exciting. Also, converting course material into an online version can inspire revisions in course content.

Recommendations

One of the most important steps in conducting an accurate cost-benefit analysis is converting all the costs and all the benefits into monetary amounts. This is very difficult, especially for the value-based benefits. In fact, the IST department did not have figures for these benefits. When conducting a cost-benefit analysis, it is recommended to have monetary amounts established for all costs and all benefits. Each institution should determine the value of these benefits, independently.

It is recommended that tuition be increased if the DM student enrollment is to remain capped at 20 students. Presently, all DM students pay residential tuition rates. This could be raised, especially for the DM students who are not residential students. The $30 DM fee could also be raised. These changes in tuition and fees would lower the costs to benefits ratio.

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Technology Integration and Innovative Teaching Practices: A Staff Development Model for Facilitating Change

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Abstract

Thirteen K-12 teachers participated in a technology integration professional development course that included course components such as peer modeling, peer collaboration, and reflection in an authentic learning context. The study purpose was to explore how teachers' beliefs, practices, and self-efficacy changed in this learning environment. Preliminary results indicate evolving teacher beliefs and practices as related to these course components. Results also indicate a significant increase in teacher self-efficacy, based on pre- and post-course survey scores.

Introduction and Background

While literature shows that barriers and challenges to effective technology integration exist even among exemplary users (Becker, 1994), it may be possible to address some of these barriers through professional development strategies. For example, research suggests that peer modeling and reflection may be effective strategies to move teachers along the technology integration continuum (Bandura, 1997; Dwyer, 1996; Gilmore, 1995; Schunk, Hanson & Cox, 1987), such as moving from a traditional to a constructivist (or integrated) learning environment (Grabe & Grabe, 1998) Peer modeling of effective teaching and technology integration strategies may result in increased teacher confidence and competence (Bandura, 1997; Gilmore, 1995; Pintrich & Schunk, 1996).

Further, providing models of exemplary teachers in a staff development setting may facilitate changed teacher beliefs about technology integration through structured exploration of those beliefs (Ertmer, Gopalakrishnan, & Ross, 2000). Seeing other teachers similar to oneself in a successful technology integration capacity may cause one to examine and possibly revise those beliefs.

A related professional development strategy is teacher collaboration, whereby teachers share ideas and strategies through discussion with computer-using peers (Dwyer, Ringstaff, & Sandholtz, 1991; Hadley & Sheingold, 1993). Research suggests that peers provide emotional and technical support in the classroom (Dwyer et al., 1991; Hadley & Sheingold, 1993) and are found in exemplary-user environments (Becker, 1994). If such strategies are developed and implemented, we may increase the likelihood that teachers will use classroom technology to enhance the critical thinking and problem solving abilities of school children.

Research Purpose

Thirteen K-12 teachers participated in a professional development course, which included components such as peer modeling (including a CD-ROM model of exemplary technology-using teachers), peer collaboration, and reflection. The research purpose was to explore how this staff development model, incorporating such components as reflection, collaboration, modeling facilitated changes in (1) teachers' beliefs about technology integration; (2) teachers' technology integration practices; and (3) teachers' self-efficacy beliefs about incorporating technology. This study explores how teacher beliefs, practices, and self-efficacy changed in this authentic learning environment.

The study was guided by the following research questions:

1. How do teachers' beliefs about technology integration (e.g., role of the teacher, assessment) change using reflection, collaboration, and modeling in a staff development program?
2. How do teachers' technology integration practices (e.g., assessment strategies, curricular emphases) change using this staff development model?
3. How do teachers' self-efficacy beliefs about integrating technology change using this staff development model?

This paper will address preliminary results obtained from initial and post-course teacher interviews, course assignments, and a self-efficacy survey instrument.

Methodology

Participants

Thirteen participants in the technology integration professional development course comprised our purposive sample. Twelve teachers agreed to participate in the study at various levels of involvement. Five teachers participated in the study in a limited capacity, agreeing to share course assignments and complete surveys specific to self-efficacy relative to technology integration. One teacher agreed to participate in interviews, surveys and to share her course assignments. Six teachers agreed to participate in semi-structured interviews, observations and a self-efficacy survey, as well as share their course assignments.

The participants came from four private schools in a Catholic diocese in a Midwest city and represented a range of grades, levels, and content taught. School demographics of the course participants are provided in Table 1. Teacher information and demographics on participants and their classes are provided in Table 2.

Table 1. School Demographics for Spring 2001 (Names are pseudonyms)

Name	Student Population	Ethnic Makeup	Grade Level
Hilltop	285	Approx. 4%	Pre-K to 3
Fairview	293	Approx. 9%	Pre-K to 6
Middleton	133	Approx. 4%	Grades 4-6
Elm Creek	375	Approx. 3%	Grades 7-12

Table 2. Demographics for Research Participants – Spring 2001 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
Caroline	Extensive	Hilltop	23	M.S., Elementary Education	3rd	All subjects	Began with 22; ended with 19	Mac and PC available; 3 classroom computers; printers, digital camera, scanner
Clara	Extensive	Hilltop	9	B.S., Elementary Education and Language Arts	1st	All subjects	18	Five computers; scanner, printer, 2 IBM computers, 1 I-Mac, 2 Macs
Greta	Extensive	Hilltop	18	M.S., Education	2nd	All subjects	19	2 I-Macs, printer
Kathy	Extensive	Fairview	6	B.S., Elementary Education	3rd	All subjects	Began with 18; ended with 19	1 I-Mac, 1 Apple, 2-Emates, printer
Eleanor	Extensive	Fairview	10	B.A., Elementary Education	4th	All subjects	26	2 Apples, 2 Macs, and a printer. Library: 2 I-Macs, approx. 10 E-Mates. Several people in building to ask for help.

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Jennifer	Extensive	Elm Creek	15	B.S., Math.	7th and 8th	Math and Geometry	21	Computer, scanner, Fax, printer; access to computer lab
Julia	Extensive	Elm Creek	5	B.S., Home Economics	7th and 8th	Family Living; Clothing Construction	17-18 (Est.)	Access to computer lab
Amelia	Limited	Elm Creek	25	B.A., Social Studies Ed., M.A., U.S. History	9-11	U.S. History, World History	--	Access to computer lab.
Anne	Limited	Elm Creek	--	Masters, English Education	11-12	English Literature	--	Access to computer lab.
Ruth	Limited	Middleton	47	B.A., Elementary Ed., M.A., Elem. Admin.	4th	All subjects	--	2 I-Macs in class room; 28 Macs in computer lab
Martha	Limited	Middleton	13	Masters, Admin. and Supervision	Principal (18 yrs)	--	NA	I-Macs; access to computer lab
Sarah	Limited	Middleton	--	B.S., Elementary Ed., B.S. in Special Ed.	5th	All subjects	--	2 I-Macs in classroom; access to computer lab.

Research Design

The study was primarily qualitative, using a case study methodology. Quantitative and qualitative data were gathered specific to self-efficacy about classroom technology use. The qualitative data were gathered to explore and describe teacher beliefs about technology integration, changes in technology goals and teaching practices, and their self-efficacy beliefs with regard to technology use. Quantitative data were also gathered to examine teachers' levels of self-efficacy with regard to classroom technology use. Data will continue to be collected during the Fall 2001 semester to allow time for changes in beliefs, perceptions, and practices to emerge.

Procedure

The Spring 2001 semester-long professional development course was conducted once a week in three-hour sessions. Using electronic and peer models of technology integration, the course was set up to facilitate discussion about technology integration issues and to identify different strategies that might be used in the teachers' classrooms.

The course components included (1) presentation of information on problem-based learning (PBL), (2) a series of facilitated discussions, (3) presentation of the electronic models with related discussions, (4) course readings, and (5) the collaborative development of a technology-based PBL unit. These course components were based upon ideas and strategies that the teachers found useful from their experiences and knowledge gained during the course discussions and activities. The teachers also were asked to submit reflections on the various parts of the technology-based PBL unit.

Instruments

Primary data sources included initial and post-course teacher interviews, observations of teacher classrooms, surveys, course discussions, and course assignments. Course assignments included teachers' visions of themselves as technology-integrating teachers (at course outset and course end), development of a technology-based PBL unit for their classrooms and accompanying reflections. During the class sessions, group discussions occurred specific to teacher ideas about what they were seeing and how that tied in with their views and goals.

Initial and post-course interviews were conducted to learn about changing teacher visions, beliefs (i.e. teacher views about classroom organization and management, assessment) and practices specific to technology integration, as well as changes in self-efficacy. The first interview was conducted in February 2001, approximately one month after the outset of the course; the second interview was conducted in June of the same year, the week following the end of the course. Two interviews were planned for the following term (Fall, 2001) to continue to explore evolving teacher beliefs and visions, classroom practices, and changes in self-efficacy.

Observations were conducted during the course to observe class activities and teacher discussions. In addition, classroom observations of the key participants were conducted on a weekly basis to observe teacher classroom practices and technology use.

Teachers also completed a pre- and post-course online survey relative to teacher confidence (self-efficacy). This survey is currently being administered mid-term Fall 2001 to revisit changes in teacher confidence.

This survey instrument, specific to teacher confidence about their technology integration practices (self-efficacy), is an adaptation of an instrument developed and tested in Fall 2000 (Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall). The constructed instrument has three categories (planning for classroom technology use, technology classroom implementation, and assessment of classroom technology use and impact, respectively), with 10 items each, for a total of 30 items. The instrument, based on a five-point scale, asks for responses ranging from "Very confident" to "Not at all confident." Item examples follow:

Relative to *planning* for technology use, I am confident that I can:

1) define teacher/student roles in a technology -integrated classroom.
2) plan classroom activities that facilitate technology integration.
3) plan for the use of computers with large-group instruction.

Data Analysis

Introduction

Initial course assignments have been analyzed, as have self-efficacy data. Specific to teacher confidence (self-efficacy), the preliminary analysis has been conducted on initial and end of term teacher interviews and surveys.

Quantitative Data Analysis

Data were analyzed for the 12 course participants, based on their pre- and post-course survey results. Paired t tests were conducted for the self-efficacy survey instrument; reliability was also measured, using Cronbach's alpha.

Qualitative Data Analysis

Interview data (pre- and post-course) for the key participants (seven teachers) and pre- and post-course teacher profiles on teacher technology visions (all 12 course participants) were analyzed and coded inductively specific to teacher beliefs, practices, and self-efficacy (confidence), using cross-case and within-case analysis. Examples of emergent codes include "Contributors to Learning," "Technology Practice," and "Contributors to Confidence." This coding was done using Atlas.ti®, a qualitative analysis software package produced by Scientific Software Development.

Results and Discussion

Quantitative Data Results

At the course outset, teachers'self-efficacy scores averaged from 1.1 to 3.0, with a mean score of 2.2 (five-point scale) and a standard deviation of 0.67. At the end of the course, teachers' scores averaged from 1.2 to 4.0, with a mean score of 3.4 and standard deviation of 1.0. Using the paired t-test on pre- and post-course data, a value of 6.66 was obtained, significant at 0.0001. Instrument reliability for the self-efficacy instrument, based on pre-course data was 0.98; post-course reliability was 0.99.

Qualitative Data Results

Preliminary data analysis suggests the following emergent themes:

- Contributors to learning (including components of the staff development model) viewed as useful varied with individual teachers, although, the more "active" types of learning—peer models and collaboration, hands-on experiences working on the PBL technology unit, and class discussions were mentioned most often as contributors.
- There are indications of some teachers' revising their beliefs with regard to technology (the role of the student, for example).
- Overall, at course end, teachers reported an increase in confidence with regard to technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, peer support, and feelings of accomplishment. Confidence indicators included experimentation (willingness to experiment with technology in the classroom) and increased student technology use.
- Teacher technology practices included increased student technology use, including using their students to teach them. Teachers still expressed concern about assessment, classroom management and classroom organization with regard to technology use.

Contributors to Learning: Consideration of the Staff Development Model

Course components valued as learning contributors varied with the individual teacher. The strongest contributors to learning, based on post-course interviews with those teachers who participated extensively in the research, appeared to be peer collaboration and peer models (other teachers), hands-on experiences, and class discussions. To a somewhat lesser extent, the course reflections, course readings and the electronic peer model (CD-ROM) were also mentioned as being contributors.

Clara, Greta and Caroline, all teachers at Hilltop Elementary in grades 1-3, respectively, collaborated together on their technology-based PBL unit. Of the contributors to their learning, Clara and Greta both mentioned peer collaboration as being valuable. According to Clara:

> I think the biggest thing was the peer collaboration, because Caroline was so wise, in, you know, in her knowledge…where Greta and I were lacking…even the confidence…So that, and feeling that we had someone that did know part of what was going on; and it was neat working with Caroline because we found out she didn't know everything. And some of the things we learned together. [Post-Course Interview, June 4, 6, 2001]

Greta also appreciated the support that Caroline gave to her. Further, it appears that Caroline (who acted as an informal technology coordinator for the school) acted as a peer model for Greta.

> …I think Caroline was such an awesome…leader for us. She gave us a lot of—but, at the same time, a lot of the things she did—we just watched…And so, I'm hoping that I can take what I saw her doing and try and do myself. [Post-Course Interview, June 4, 6, 2001]

Greta found that her contributors to learning included the electronic peer model and the class discussions, as well as the hands-on experiences provided.

> Hands on--I liked the opportunity to do the things…but class discussions, seeing what the other people were thinking and feeling and--and doing in class. Like we would watch a video…where we would go…and see some of the teachers in action. [Post-Course Interview, June 4, 6, 2001]

Caroline found that her contributors to learning were based on the course readings, the class discussions and the reflections. With regard to the reflections:

> And the thing that's least--we griped about those reflections…But…it did make you think…and--and then I would re-examine something-even though I'd said it two reflections before, now maybe I'm looking at it in a little different way…or, um, I see where I can improve it or know that it's not even possible… [Post Course Interview, June 4, 6, 2001]

At Fairview, Kathy (a third grade teacher) and Eleanor (a fourth-grade teacher) also collaborated together on their project. Kathy found working with Eleanor helpful, as well as the class discussions.

> Well, definitely the class discussions, especially the one that we had on the security issues and privacy…I liked that one a lot. Um, and working with Eleanor helped a lot…She --she'd always have so many great ideas--I love working with her. [Post-Course Interview, June 6, 2001]

Eleanor found the hands-on experiences of the project most useful: "…All of that contributed. And, but actually doing it….The hands-on was the most--yeah, for me…" [Post-Course Interview, June 7, 2001]

It is interesting to note that these teachers overall selected more "active" methods of learning—hands-on experiences, working with others, participating in class discussions. While these components were mentioned frequently, it should also be noted that reflections and course readings were also mentioned as learning contributors. It is also possible that the electronic peer model (which was used in the course a couple of times) might have been a stronger contributor with more use.

Changing Teacher Beliefs

For some teachers, existing teacher beliefs about technology changed or were enhanced with regard to technology use. Clara learned early in the term that technology could be used as a tool, rather than her earlier conceptions of how she should use it in the classroom.

> I've learned, mainly, that technology is a tool; and I think before I thought, in reading these things and really thinking about it, I was thinking technology more as a subject?…And that-- that--I teach across curriculums…I was looking at technology as another subject area, rather than seeing is a tool that enhances subjects areas I already have, so that's where my whole thinking has changed, and I can see now that this can be a really great, effective way to teach some of the--my areas to enhance them… [Initial Interview, February 8, 2001]

When asked at course end what the main thing that she had learned was, Clara reiterated, "All right, the biggest thing for me is that I know the computer is a tool. Where before…I had the idea that they wanted me to use the computer for almost everything." [Post-Course Interview, June 6, 2001]

Although her beliefs about the value of technology had not changed, Jennifer, a 7th grade Math teacher, spoke of revising or revisiting her beliefs about the role of the teacher, specifically teacher-directed learning in the classroom. Class discussions and course readings reinforced her beliefs.

> To a certain degree I would have to say that my ideas about technology have not changed that much. Prior to this course I felt technology was an important tool for educators to use to help better educate our students. I think that the ideas we have discussed and the material that I have read have just reinforced this belief. In fact, I am more motivated and convinced that I need to find even more areas to implement technology into the curriculum.
>
> As a result of developing my problem-based unit, I have learned, or been reminded, that technology makes learning more student-centered. I think I would be very naive, even wrong, to believe that all students learn best in a teacher-centered classroom. I have found myself asking "Do the students really need me to show them how to solve a linear equation (any math concept for that matter) or could they discover this on their own?" [Technology Vision Revisited, April 24, 2001]

Julia found that the course reflections helped her reach an insight about her students and active teaching methods, with regard to the student role in the classroom and the benefits to them long-term.

> When Amelia and Jennifer and I were working on the PBL Group Presentation, we had three different ideas as to what was expected of us, three different propositions on how to approach it and three different thoughts on how to organize it…I remember commenting that I wanted my classwork organized for me and presented in a neat little package because the whole rest of my life consists of problem-based learning. As the semester unfolded, I became aware of how very true this was of me and the adults around me. What better way to teach my students skills for life than to engage them early in PBL! Could I really teach them anything more important? [Technology Vision Revisited, April 24, 2001]

Teacher beliefs are not easily changed, and traditional roles in the classroom can be hard to overcome (Ertmer et al., 2000; Fullan, 1993; Schrum, 1999; Van Haneghan & Stofflett, 1995). As Schrum stated, "Teachers need compelling reasons to change their practice" (1999, p. 85). In the above examples, it appears that the components of the model may be helping some teachers consider and possibly revise their beliefs with regard to classroom technology integration.

Increased Confidence, Confidence Contributors and Indicators

Post-course interviews and post-course teacher profiles (visions of technology-integrating teachers) indicated increases in confidence for five out of seven course participants with regard to classroom technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, support, and feelings of accomplishment, as well as the opportunity (and willingness) to experiment with technology in the classroom.

For Kathy, the third grade teacher at Fairview, an increase in knowledge also related to her confidence in classroom technology use, as well as willingness to ask for support.

> I still believe that technology is a wonderful and exciting way to teach and motivate students. I feel somewhat less overwhelmed by the amount of information and software available. I have more confidence in myself and my abilities to utilize technology. In addition, I no longer feel embarrassed to ask for help when I need it. [Technology Vision Revisited, April 24, 2001]

According to Ruth, a fourth grade teacher at Middleton, fear and lack of knowledge has been replaced by less fear, more knowledge, and a sense of accomplishment, as well as experimenting with technology in her classroom.

> I have to admit, I came into this class fearful, apprehensive and knowing -- not much -- about computers or their use. Now I have to admit that I have enjoyed this work and I am definitely not as fearful about computers as I was at the beginning. I even try things and often am successful at what I try e.g. making vocabulary charts --using e- mail -- using the internet. I can even talk a little intelligently about some areas in the use of the computer. [Technology Vision Revisited, April 24, 2001]

Ruth's successes with technology use appeared to result in increased classroom technology use:

> Since I'm less afraid and apprehensive I've changed my mind about computer use in the classroom too. I have learned to use the internet productively. Finding work that fits with my class especially for science. I have encouraged the students to use the internet for reports for class. I have used the computer to make charts for classroom use. I am planning to use the computer for my grading program this fall. [Technology Vision Revisited, April 24, 2001]

Peer support and accomplishment continued to contribute to confidence, as well as hands-on experience. Greta found that working with Clara and Caroline helped her confidence and her learning, as did the hands-on experience. When asked about confidence contributors, Greta answered:

> Yes, and doing it with Caroline, you know…and working on our—just getting that whole page together, as I just said, it turned out marvelously because of Caroline, I think…But--cause having her-in the group, that made me be able to say, "Yeah, I can do that," you know, or "How did you do it, Caroline?"…Trying to get so that I would learn from her. [Post-Course Interview, June 4, 2001]

Kathy believed that the changes in her classroom could be attributed to her increased confidence and hands-on experience, which led to her increased technology use and experimentation.

> I guess, mainly my confidence has gone up, so that created a change. And that started with the discussions and…actually getting in and using the computers, and finding new things to do with the computers myself. [Post-Course Interview, June 6, 2001]

As their technology journey continued, teacher confidence with regard to technology use increased overall, due in part to hands-on experiences, support, increased knowledge, and feelings of accomplishment. Indicators of such confidence were reflected in their encouragement of and confidence in increased student computer use and willingness to experiment with technology.

Teacher Technology Practices

Perhaps in part due to their overall increased confidence with using technology in the classroom, many teachers are trying out new ideas with regard to technology. In doing so, they are addressing challenges such as classroom organization and management, as well as time constraints.

Clara described a successful use of technology for her, one that she had only tried out that term with her students:

> Each one wrote a little, um, paragraph about themselves…and then they had to find some Clip Art or something that looked…that showed--reflected them…and put it on their--their paper…and print it out. And we did get that done! So that was successful…I think because the children enjoyed it so much. They were able to follow the directions. They ended up with a good product…and they had fun. [Post-Course Interview, June 4, 6, 2001]

Clara also had her students working on researching a dinosaur project on the Internet, using the students to help each other.

> What I tried to do there is put someone that was more computer-literate, someone that could read well…with someone that was a little bit lower…so they could work. So sometimes, I didn't have as many high students, so sometimes the high student would work with three or four…students at different times. [Post-Course Interview, June 4, 6, 2001]

Eleanor had her students teach her how to use KidPix, preparatory to using her technology unit, which she had developed with Kathy, the following term. In doing so, she and her students used KidPix to run ads on the VCR monitor during their Mini-Economy activity:

> Um, I've kind of--we've had classes before on technology, so I was aware of a lot of this stuff, but planning our unit, we were planning on using KidPix and I had never done that before…and so I did go ahead and, um, look at it and then use it at the end of this year, so that I'll, um, be more able to jump into the unit next year.
>
> hat was a lot of fun. And here, um, a couple of my student experts helped me cause…they had it at home and helped me how to use it and, um, so I had no idea what I was going to do with the kids, but we ended up doing, um, our ads with our Mini-Economy on there…with the--the music and the--the slide show and that--that was really cool. [Post-Course Interview, June 7 2001]

Kathy began organizing her classroom and time such that her students had greater access to and time to work on the computer.

> Um, we set up a time during the day when people would have to go back. They couldn't just...you know—because sometimes some of the kids are intimidated by it, and they would...kinda say, No, I don't want to today, I'll do something else," but...we'll say, "Yes. You go." [Post-Course Interview, June 6, 2001]

As might be expected, teachers are still evolving in various aspects of technology practice. Caroline expressed concerns about assessment:

> You know, I still--I was--the assessment issue is still something that--I feel better about it. I don't know that it's something I do as well as--as I could or should. Sometimes I fly by the seat of my pants. [Post-Course Interview, June 4, 6, 2001]

Greta discussed her challenges in dealing with classroom management, ensuring that all students had the opportunity to work with the computers.

> I think that--yeah--the challenge is—is still how to give everyone the opportunity. How to utilize my time...The management of it. Um, this room is small...And so, my stations were never really--so they went to one station and did this, whereas in our project, the whole thing set up. So there would be four different groups or so and they would be doing different things, so that I would be working with one group...hopefully at the computer, or moving about to help some of the others, but I was hoping to make the groups such that there would be a leader type in each one, who could keep the group kind of going. [Post-Course Interview, June 4, 2001]

Conclusions and Future Implications

Impact of the Staff Development Model

It appears that the course components were (perhaps, not surprisingly) of value to different teachers in different ways. The hands-on experience, as part of the PBL technology unit, was mentioned often as being useful in terms of increased knowledge and confidence. Peer collaboration was particularly useful to those who looked to "leaders" to help them in skill building and developing web pages. Reflections were useful for "rethinking" where they were and where they are going. In some cases, reflections may have contributed, in part, to changing teacher beliefs.

Overall, the impact of the staff development model appeared helpful in terms of changing teacher beliefs and practices. Participants did not directly say, "This component helped me change my practice." However, in the sense that the various components contributed to increased knowledge and confidence, it may be termed useful. Pre-course profiles indicated that teachers vary from traditional teaching approaches toward more integrated approaches to classroom technology use (Grabe & Grabe, 1996). While further analysis is needed to confirm these initial results, this may lead to an interesting contrast relative to changes that may occur as a result of the professional development course, given the diversity of approaches.

Further Data Analysis Needs

Initial interview data with seven teachers appeared to indicate that their school cultures encourage collaboration and reflection, with some teachers also referring to other teacher "models." Given the existing culture, it will also be interesting to see how teacher beliefs and technology integration practices are facilitated by such cultures, in conjunction with (and supported by) the professional development model, which also encourages collaboration, reflection, and modeling. Further analysis is needed to confirm these impressions.

As indicated above, further analysis remains to be done on course data obtained, as well as teacher interviews and observations. While preliminary data analysis has focused on teacher beliefs, practices, and self-efficacy, as well as learning contributors, results are yet to be determined in greater depth.

With regard to efficacy data analyzed to this point, results are consistent with those of Stein and Wang (1988). While many studies have examined teacher efficacy in professional development settings, often self-efficacy is measured at one point in time (Ross, 1995). However, research has shown that teacher efficacy may be curvilinear across time (Stein & Wang, 1988). According to Stein and Wang (1988), teacher self-efficacy may increase during a professional development course, then decrease as the teacher attempts to put what was learned into practice, then later increase again as the teacher masters what was learned. It may then be useful to measure teacher self-efficacy, not only during a professional development course, but also as a follow-up (as in the following term) in the teachers' classrooms.

From the results on self-efficacy collected thus far, it appears to support Stein & Wang's (1988) conclusions. The survey instruments are currently being completed by the teacher participants (mid-term Fall 2001), and these data will contribute to the knowledge base on the curvilinearity of the results specific to teacher self-efficacy, as well as idea generation. Repeated measures data may confirm (or disconfirm) the nature of teacher efficacy across time.

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LARGE SCALE INTERVENTIONS: AN HISTORICAL CASE STUDY OF FLORIDA SCHOOLYEAR 2000

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Abstract

Throughout the ages, men and women have struggled with educating their young in the most effective and efficient ways possible. They have learned the value of education is not a unique interest of a family, community, state, or nation. Education is now embraced by a global society and serves as the equalizer for the betterment of all. *To meet this responsibility, it becomes society's challenge and opportunity to identify, design and develop interventions that provide quality education. Therefore, this research study focuses an historical case study on a large-scale intervention called Florida SchoolYear (SY2000), which was a visionary example of how the state of Florida tried to design and develop a means for delivering quality education.*

By studying the Florida SY2000 Initiative, this research study examined issue-oriented questions (e.g., impacts and influences) that confronted those individuals and groups who sponsored and advocated a large-scale reform effort designed to drive educational change in Florida K-12 schools. Conveying the research findings through an historical case study allowed the story to unfold as each informant had his/her own perspective and story to tell, from which, collectively, patterns, understandings, and recommendations were drawn.

The outcome of this research study was the presentation of SY2000 sponsors' and advocates' perceptions of what happened during SY2000, what they believed should have happened, and what they wished would happen in future education reform efforts. These individuals were selected based on their leadership or influential roles and positions held during SY2000.

Data that emerged via surveys and interviews addressed:

- *Factors that affected the implementation of SY2000 (e.g., differing cultures, leadership, vision, buy-in, sustained commitment, and change process);*
- *Costs of implementation factors (e.g., research and development, allocation of resources, measurable results, time, and technology use and support); and*
- *"Lessons learned" (e.g., perceived effects of SY2000, obstacle of misaligned cultures, value of research and development, importance of deciding whether to redesign or recreate, criticality of having shared vision and mission, and the power of strong leadership).*

The researcher presented limitations of the research study and future research dealing with large-scale interventions. The researcher concluded this study by challenging the reader to a new way of thinking in terms of education reform (Russo-Converso, 2001).

Introduction

This historical case study focused on a large-scale intervention called Florida SchoolYear (SY2000), which was a visionary example of how the state of Florida tried to design and develop a means for delivering quality education. SY2000 was a seven-year (1989-1996) collaborative program among nine Florida districts, the Florida Department of Education, the Florida Department of Health and Rehabilitative Services, and the State University System, led by Florida State University (FSU). The purposes of SY2000 were to redesign and implement a technology -supported system of schooling. Total funding for the program, including investments made by private corporations and district "in-kind" contributions, exceeded $30 million.

The research revealed an in-depth look at how the experience of SY2000 influenced SY2000 sponsors and advocates. Respondents' stories explained what happened during SY2000, what they thought should have happened, and what they wish would happen in future reform efforts.

Therefore, the focal points of this case study centered on SY2000 sponsorship and advocacy and the "lessons learned" by those individuals having had those roles. For the sake of this study, definitions of sponsors (initial and sustaining) and advocates were based on the work of change management/leadership expert Daryl Conner and findings he presented in Managing at the Speed of Change (1992) and Leading at the Edge of Chaos (1998).

A sponsor is defined as an individual or group who has the authority to legitimize and power to enforce the intervention (e.g., the Florida State legislature). Sponsorship involves far more than ideas and rhetoric; it requires the ability and willingness to apply the meaningful rewards and pressure that produce desired results. Major change will not occur unless appropriate sponsors demonstrate sufficient commitment. There are two kinds of sponsors, initial and sustaining. An initial sponsor is defined as an individual or group who has the power to break with the status quo and sanction a significant change. An initial sponsor is usually higher in the hierarchy than those who must perform the duties of sustaining sponsors (Conner, 1992). A sustaining sponsor is defined as one who supports and follows through with the sponsor commitment and allocation of resources for his/her arena of influence. A sustaining sponsor has enough proximity to local targets, those individuals or groups who must actually change, to maintain focus and motivation on the change goals (e.g., Florida State Department of Education or SY2000 operational test site school superintendents). Sustaining sponsors minimize logistic, economic, or political gaps that exist between

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layers of the organization (education system) and produce the appropriate structure of rewards and punishments that promote achievement (Conner, 1992).

An advocate is defined as an individual or group who wants to achieve a change but lacks the power to sanction it. However, advocates are influential and valued for the advice and recommendations given to the sponsor and others (e.g., Public School Council or Policy Advisory Council). Successful advocates spend time with sponsors as they engage in remedy selling (e.g., problem solving and persuasion/communication) and pain management (e.g., dealing with resistance, barriers, and constraints). Advocates help the sponsor realize the importance of the desired change (Conner, 1992).

To understand the roles and influence of sponsors and advocates, the following assumption must be carefully analyzed: There is a tendency for those involved in or affected by a change initiative to overestimate the short-term effects of change and underestimate the long-term effects (Conner, 1992; Reigeluth & Garfinkle, 1994). The short-term effects are the results of incremental inputs and processes. The conditions for successful implementation and sustained change are greatly influenced when short-term effects are internalized and institutionalized. Change transforms into long-term effects when people are results-driven and have been given purpose and value as to why the change is required. Initial and sustained sponsorship are key to making this type of transformation/change possible. The following display (see Figure 1) is an example of a systems approach to educational reform. This operations model was created during Florida's SY2000 educational reform initiative and presents a proposed education system and related subsystems. Having no intent to show linear relationship, the subsystems are connected by a circle. The circular pattern shows connectivity or inter-relatedness among the eight subsystems (i.e., mission, curriculum, instruction, student and family services, assessment and information management, human resource development, management operations, and logistical services).

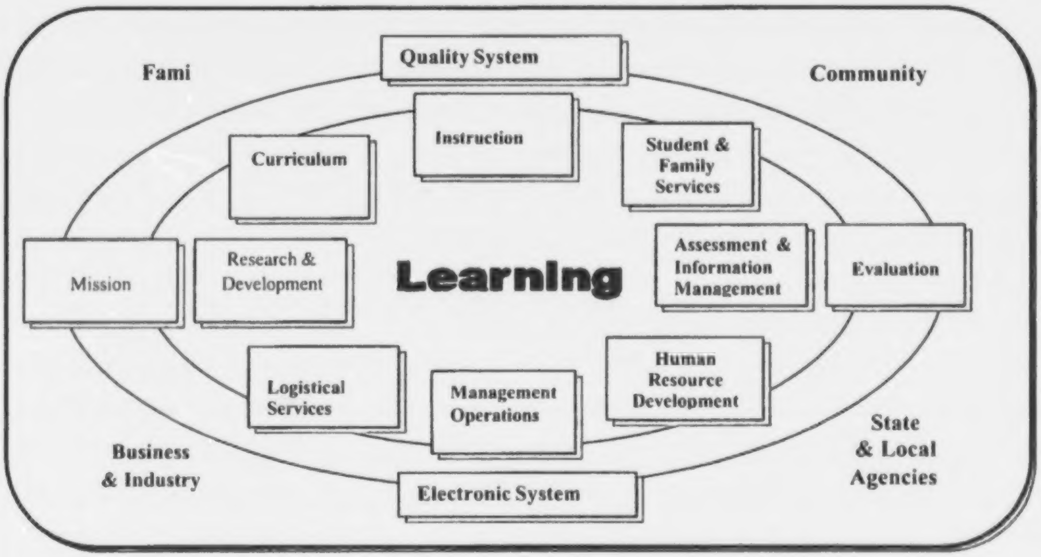

*Figure 1. **SchoolYear 2000 Operations Model.***
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A working design team backed each SY2000 subsystem. Each design team was composed of FSU/CET design team leaders and staff, school district administrators, teachers, parents, and school community members. The design teams met on a regular basis to design and develop SY2000 interventions and products.

Depicted in each of the four corners is an external client (stakeholder – one who influences or interferes with an innovation) who is directly or indirectly affected by any change within or to the system. The circular shape forms the framework that signifies an iterative process of continuous improvement that is driven by quality and electronic systems.

The Florida SY2000 Initiative was a comprehensive attempt to change how education was being delivered and applied in the state of Florida. Based on his "upper-limit hypothesis" (Branson, 1987, 1998), Dr. Robert K. Branson, director of FSU's Center for Educational Technology and primary leader (principal investigator) of SY2000, offered the following rationale in 1987 for changing how education was currently being delivered. "As we look at the future, we in education have two paths we can consider. We could continue down our current path and experiment with a series of new educational alternatives, or we could realize that the current system might be performing at its peak and it was time to consider a new system. SchoolYear 2000 was a way of heading down that second path" (Branson, Retrieved February 17, 2001 on the World Wide Web http://cpt.fsu.edu/sy2000/WHYNEED.HTML).

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Implementing SY2000 was a major change that required knowledge, skills, and resources required for moving from where the state of education was to where it should be. It was a major transition and transformation for people and processes. The greatest challenge was to sustain the change for the long journey, making a difference in the lives of tomorrow's child.

Leading change and diffusion of innovation experts highlight the critical roles of leadership and sponsorship for the successful implementation and maintenance of major change or reform efforts (Conner, 1992, 1998; Ely, 1990; Rogers, 1995; and Waterman, 1990). It is for this reason that sponsors and advocates were selected as the target audience for this historical case study research. The purpose of this study was not to judge right or wrong, true or false, significant or insignificant, but rather to offer a deeper and richer understanding of what happened, why it happened, and ultimately, what were the long-term effects of SY2000.

Factors Affecting Implementation

What does it take for an implementation to be successful? What factors cause concern if they are not implemented correctly? Many agreed that SY2000 was not strengthened when important implementation factors were not effectively executed. In this section, eight implementation factors are discussed that emerged from the SY2000 survey and interview data. Most factors aligned with Ely's (1990) conditions for successful implementation (i.e., leadership, participation – buy-in, commitment). Other factors that aligned with Ely's conditions appear in the next section as implementation costs (e.g., resources, knowledge and skills, training, time). To summarize the factors that affected the implementation of SY2000, one must consider the importance of each.

Differing cultures

There were three distinctive cultures that had initially rallied to form a synergistic partnership (i.e., government – State Legislature; university – FSU/ CET; and schools – SY2000 CSD). However, over time communication was difficult to manage among these differing cultures. Each culture was interpreting events and taking action based on its respective set of assumptions, beliefs, and behaviors. For communication to be effective, individuals and groups from each culture should have had the opportunity to learn about the others' cultures in order to reach agreement on what would be the best action for all.

From the data analyzed, I was skeptical about whether SY2000 leaders and participants understood the varying cultures from which participants or stakeholders had emerged. The data indicated that each participant seemed to have his/her respective and unique set of beliefs, assumptions, and behaviors. This was by far the mostly noted factor by respondents. It was the general belief that SY2000 did not plan for the management and education of those representing the differing cultures (e.g., government, K-12 schools, and university).

Leadership

Many change experts state that leadership is crucial to successful implementation (Ely, 1990; Conner 1992; Rogers, 1995; Lick & Kaufman, 2000). SY2000 was dependent on the capacity (willingness and ability) of its leaders to systematically design and deliver a large-scale reform initiative. SY2000 leaders had to anticipate the implications of implementation. By doing so, they would have realized the impact of clearly articulating SY2000's vision and philosophy to others. Many respondents perceived this role to articulate and communicate with sponsors in government, university, and schools as that of the SY2000 advocates. This factor was critical for identifying the assumptions, beliefs, and behaviors of differing cultures and finding ways to manage and educate their understanding and sustained commitment and buy-in for successfully implementing SY2000.

Vision

As mentioned earlier, articulation and communication of an initiative's vision, goals, and objectives is critical for participant and stakeholder buy-in. The SY2000 vision was for each student to acquire the foundational skills and competencies needed to succeed in adult life in an Information Age. SY2000 was designed as a learner-centered approach for teaching and learning. The goal of SY2000 was improving learner achievement and performance.

It is critical for participants and stakeholders to share the vision (Conner, 1990; Barker, 1993, Lick & Kaufman, 2000). The vision is the guiding star and gives purpose to the innovation. However, respondents often mentioned how the vision was not well articulated and therefore not well understood.

This factor closely related to the factors of leadership and buy-in. Respondents agreed on the criticality of a shared vision, a vision that all stakeholders understood and believed to be the goal of SY2000. When participants lost sight of the goal, strong leadership would again clear the path for them to see the vision. When participants changed (e.g., sponsors or advocates), astute leadership should have educated the new participants of the SY2000 goals and objectives and attained their buy-in and commitment. Buy-in and commitment should have been based on developing synergistic partnerships, getting people together who are willing and able to bring about change.

Sustained commitment

Buy-in, often associated with commitment, is another critical factor for successful implementation efforts (Conner, 1992; Lick & Kaufman, 2000). Buy-in must come from the participants and stakeholders of the innovation. With continuous buy-in (sustained commitment) they will develop the required capacity (willingness and ability) to achieve desired results. And with buy-in, support for the effort is provided necessary resources to achieve results – time, money, and people. Without buy-in, resistance to change flourishes and becomes a serious obstacle to successful implementation.

School districts began to question where SY2000 was headed, leading to the breakdown in dedication and commitment of school districts to SY2000. A CSD District Administrator expressed this sentiment when she said, "SY2000 should have designed incremental results built on goals. An urban superintendent's life is a little over two years. To keep a district involved and committed to the goals of SY2000, you have to create something that shows progress within short periods of time." This was the factor that means getting people to stay together through completion or achievement of goals and objectives. This is the factor that respondents perceived waned over time. Many believed that when SY2000 champions lost interest or were no longer involved, sponsorship was lost along with allocation of resources.

Communication is how one articulates and conveys a message. Communication during a change initiative is critical (Conner, 1990; Lick & Kaufman, 2000). Change participants are dealing with ambiguity and uncertainty. They are venturing into new frontiers, and with that journey comes a natural resistance to change, to thinking and doing different things. Along with strong leadership, a structure and organization has to be in place for the flow of communication to permeate all levels of participants and stakeholders. It is often said that knowledge is power. In the case of SY2000, knowledge was the foundation on which to build a powerful system for education reform.

Change process

Within the structure and organization of a reform effort, leaders must prepare the organization for change. For SY2000 to be a success, participants and stakeholders had to be prepared for the change effort. There should be a change a process for creating and managing change. Without an understanding on the part of the participants of the reform effort, over time, synergy and communication dissolves, participation wanes, and eventually interest and commitment erode. This lack of synergy and communication was an issue raised by many of the SY2000 participants surveyed and interviewed.

A CSD District Administrator explained, "The entry point for change in Florida schools is the district. Change happens school-by-school, and significant educational reform is possible district-by-district. It would be very difficult to create a rubric to measure reform outcomes at the state level, but it can be done at the district and school level. You must tie the goals of the intervention to the agreed-upon rubric."

This factor dealt with getting people to shift from "what is" to "what can be." Respondents felt sponsors or SY2000 leaders didn't recognize the "what is" to find appropriate solutions to move towards "what can be." The lack of having enough time and resources was blamed for the change process not being fully implemented.

From the people I interviewed (i.e., initial sponsors, sustaining sponsors, and advocates), I heard many times that they were eager and willing to learn and that they wished SY2000 leadership had anticipated the time and effort required for communicating and articulating the SY2000 vision and measurable outcomes. Realizing the value of implementation factors mentioned in this section, one must also understand there are costs associated with implementing change. The following section brings to light the costs that SY2000 had to anticipate, consider, and manage.

Costs of Implementing Factors

There are costs associated with successful implementation. Survey respondents (69%) agreed or strongly agreed that the sponsors of SY2000 were aware that personal, political, or system cost might be required to implement SY2000. Even though the perception was that sponsors had this understanding, the survey data showed no consensus as to whether sponsors displayed strong commitment to SY2000 - 75% of the respondents were split evenly among *agree* and *disagree*. Supporting these data were the survey and interview comments, which reflected a perception that sponsors did not manage the costs well. To summarize the cost factors for implementing SY2000, one must consider the importance of each.

Research and development

R&D are perceived as valuable inputs for any change effort. R&D identify theories, models, and current best practices associated with the design and development of a new initiative. R&D are major components of an iterative process and, as a result, are ongoing throughout the systematic design phases. Most respondents appeared to recognize the value of R&D but perceived that it was not valued by SY2000 sponsors (i.e., legislature and school districts) and should have been developed with a broader base (e.g., greater university and college input throughout the state of Florida). R&D were not highly valued by government. Politicians were under pressure to produce tangible results in the eyes of their constituents. FSU/CET was placed in a hurry-up mode to produce products to satisfy this pressure which distanced them from their expertise of R&D.

Allocation of resources

Funding was a major issue with all respondents. They realized that a large-scale education reform like SY2000 required a large sum of money and long-term support. This effort was not a tweaking of the current system, but the creation of a new way of schooling. The cost to bear was the long-term commitment of sponsors to allocate required resources – time, money, and people. Over time, the CSDs and FSU/CET resented the legislative year-to-year funding of SY2000. From the very beginning of SY2000 it was explained that it would take ten years and $100M to fully implement the proposed changes in Florida schools. Pressure mounted each year to produce tangible results in order to justify continued funding.

Measurable results

As stated in previous sections the lack of measurable results and outcomes were mentioned time and time again. Promoting an initiative's worth and value depends on the perception of its success and goes hand-in-hand with continued allocation of resources. This factor was perceived by many to be the demise of SY2000. The respondents' felt there was a lack of milestones or deliverables to justify the pressure mounting in the legislature, or to answer questions raised by CSD principals and teachers as to where SY2000 was headed.

Time

It is often said that time is a variable, not a constant, when dealing with change (Ely, 1990; Conner, 1992). Time can be shortened or lengthened on paper, but in reality it can not be tampered with without the buy-in from those who will be implementing the change. Many respondents felt time was being forced by the legislators by the pressure to produce tangible results. Others felt the university did not understand where school districts were along the change process spectrum and felt there was no time to catch up to other participants, or conversely, wait for other participants to catch up. Therefore, it was the perception of many respondents that time to implement a change initiative should not be dictated or mandated. Most respondents referred to time as a cost dependent on the demonstration of measurable results. Time was perceived as a valuable resource, but one not afforded for SY2000 to be successful.

The respondent comments demonstrate that there were many lessons to learn from having had the experience of SY2000. The next section addresses the lessons learned as described by SY2000 participants. However, the real impact will be if the lessons learned encourage the reader to reflect on these past experiences to plan and design future initiatives.

Lessons Learned

One of the greatest accomplishments in any reform endeavor is the learning that takes place. Through reflection one has an opportunity to gain insight personally (and collectively with others) about what worked, what didn't work, and what may have worked. It is from these insights that individuals or groups can create brighter visions, better plans, more effective solutions, stronger actions, and more useful evaluations for future reform efforts. Following are my interpretation of the *lessons learned* as expressed by survey and interview respondents. My interpretations are represented via the following categories:

Perceived effects of SY2000

This study was an examination of how the experience of an innovation had an affect on its participants. Therefore, survey participants were asked to state the greatest personal impact that they could directly or indirectly attribute to having had the experience of SY2000. It was surprising that many of the personal effects related to system issues or broad views (e.g., implementation factors, politics, quality systems, and strategic planning). My interpretation of these perceptions is that many of those surveyed and interviewed realized they were individuals working together within an organization (e.g., governmental, academic, corporate). Perhaps this was the reason why personal impacts were expressed in terms of wholes – education system, and not parts – the individual. Another reason why personal impacts were viewed globally may have been because of the background and experience of those surveyed and interviewed. I had contacted the perceived *movers and shakers* of SY2000 of which many continue to serve in leadership roles. These individuals tend to think "big picture" and see the spectrum of impacts of change on their respective organizations before, during, and after reform efforts. It would be interesting to examine the perceptions of those that were and remain in management or operational roles (e.g., principals, teachers, and school support personnel) to see if they too view things from a broad perspective.

Differing cultures

It is my thought based on the surveys and interviews that the most damaging obstacles for SY2000 becoming a successful large-scale reform effort were the differing cultures (i.e., government, university, and K-12 schools) that remained intact with their respective assumptions, beliefs, and behaviors. It was futurist Alvin Toffler who aptly said, "The illiterate of the 21st century will not be the one who can not read and write, but the one who can not learn, unlearn, and relearn." From the data, I believe *learning* emerged as the critical factor in getting people from differing cultures to come together, stay together, and work together.

Research and Development

SY2000 was a research-based change reform initiative. Many of the school-based and corporate (e.g., university, K-12, and corporate) respondents agreed on the importance of R&D and its role in developing SY2000 concepts and products. However, these same respondents made it clear that LSI/CET spent too much time and energy in product development when their expertise was in research and development of concepts, theories, and models. And these respondents were critical of the state legislature for not valuing R&D as they should have in terms of allocating required time and money.

Redesign or Recreate

Where do we go from here? Do we redesign or recreate? Whether reformers choose to redesign education by doing different things in the current framework or whether they choose to recreate education by doing things differently using a new framework, all agree something must be done to improve our student achievement and performance in our preK-20 education system. The respondents raised many questions based on their comments and reflections regarding wishes for education reform (see Table 1). Answering these questions is the challenge we educators have before us; although, I believe questions present an opportunity for us to design a successful large-scale reform initiative.

Table 1. Respondents' wishes and questions raised for future education reform.

Respondents' Wishes	Question Raised
Allocation of resources	How money, time, people, and training will affect the implementation of a large-scale reform effort
Creation of a systemic design	Why a systemic design should be valued as the foundation for large-scale education reform
Development of a change process	How a change process should adapt to the capacity levels (i.e., willingness and ability) of sponsors, advocates, and participating school districts and individuals
Development of a systematic design process	How a process should give organization and structure to the implementation of a large-scale reform effort
Establishment of leadership and support	Why the importance of establishing communication and articulation with and between sponsors and advocates
Formation of partnering	Why the importance of establishing communication and collaboration among co-development partners
Decision for where do we go from here	Why the question of whether to redesign or recreate is raised

Many of those surveyed and interviewed gave the impression that merely redesigning what we are currently doing is not the change required to make the difference for today's and tomorrow's child. From their comments, I believe they prefer doing things differently, a primary focus was on outcomes for learning and the learner, but a secondary focus was on a change process, a process that includes and is dependent on how to make it happen.

Driving force for Education Reform

Shared Vision and Mission: For large-scale education reform to be valued and deemed imperative by sponsors, advocates, change agents, and change targets and external stakeholders (i.e., business/industry, families, community, state and local agencies) it is important for each individual/group to agree on the reasons for doing so. It is critical to share the vision and mission if change is to be successful.

The Goal of Education Reform Initiatives

2000 was designed as a learning-centered system for schools in Florida. This study's surveys and interviews with national and state leaders of education reform confirmed this premise. The true driving force of a school system is curriculum, instruction, and assessment (CIA). It is CIA from which all other education system functions serve as supports and resources.

CIA as the driving force of a school system was discussed duringan interview with a CSD District Administrator. He began to draw an illustration to depict the driving force behind a school system. He drew a straight line of boxes labeled with different operational functions within a school system (e.g., Management Information Services (MIS), Legal, Finance, Student Services, Facilities, Personnel, and Human Resource Development (HRD). The administrator explained that most school, district, community, state, and public attention and resources are spent on these operational or functional supports. In contrast, in his 30+ years of service to public education, he believes the attention and resources must be spent on the true driving force of a school system, the curriculum, instruction, and assessment (CIA). He said research and development provide inputs to CIA, and CIA serves as the direct path to the teacher and student, for it is CIA that directly impacts student learning, achievement, and performance. I began to share my thoughts and ideas and together we developed the following CIA driven school system model (see Figure 2).

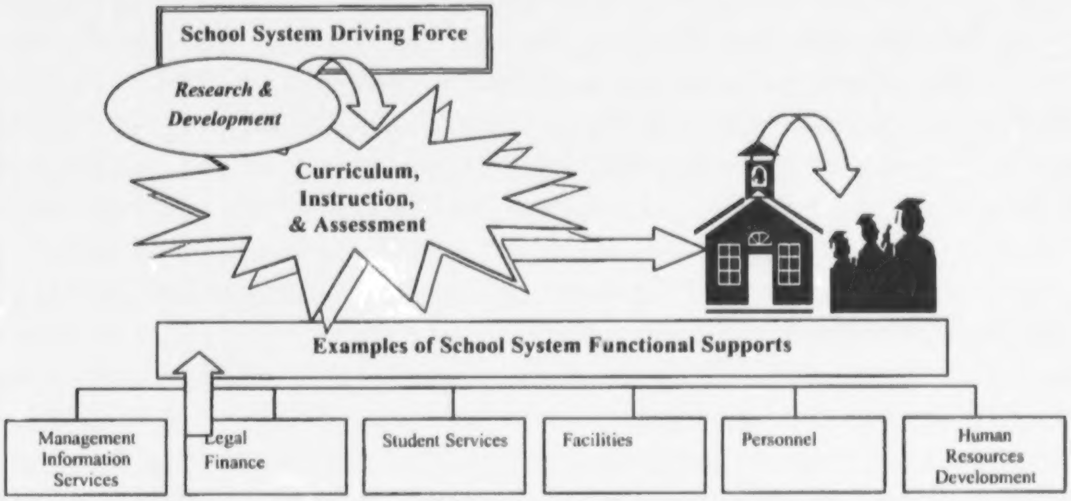
School System Driving Force
Research & Development
Curriculum, Instruction, & Assessment
Examples of School System Functional Supports
Management Information Services
Legal Finance
Student Services
Facilities
Personnel
Human Resources Development

Figure 2. Driving force behind a school system: Curriculum, instruction, & assessment.

Leadership

Finally, I will close this section on lessons learned by addressing what I feel is the most critical component of any organization undergoing a change effort, leadership. From the literature review, the interviews conducted during this study, and the years of experience in public school education, I have learned that collaboration among participants of a change effort cannot be derived, but rather is built over time. One can bring players together, but it is ultimately the players who will decide if, when, and how they will work together. I have developed a model of leadership for education reform (see Figure 3).

The first step is getting participants to sit at the table. Implementing change takes a unique leader with leadership capacity (i.e., willingness and ability) to orchestrate a team of players (e.g., thinkers, visionaries, planners, designers, developers, implementers, and evaluators). For this type of leader to be effective he/she must actively involve the participants from the very beginning and sustain their involvement throughout the diffusion of the innovation to its attainment or completion. And finally, education reform requires resources (e.g., time, money, and political finesse). These resources are developed with partnerships with the state legislature, schools, universities, and business and industry and others. These individuals or groups are considered the stakeholders because they will directly or indirectly benefit from the success of the reform.

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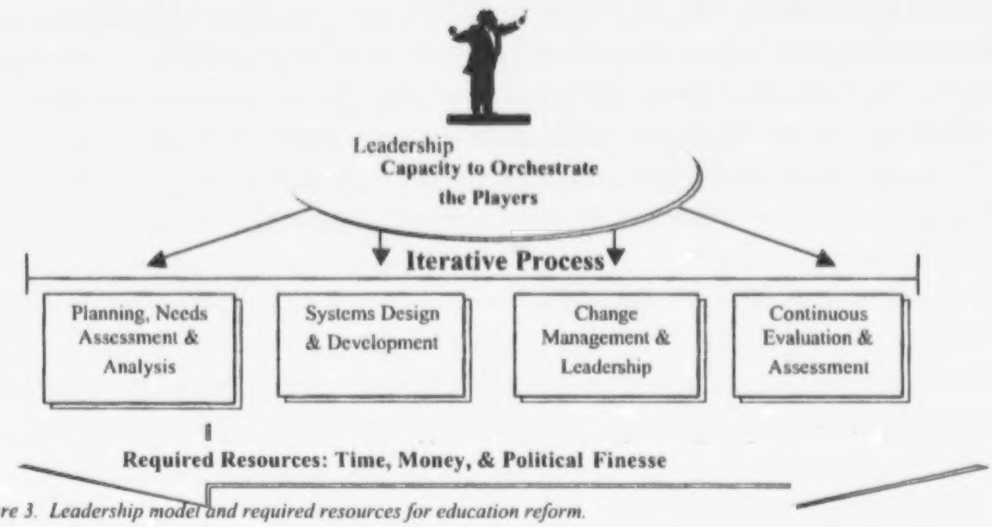
Leadership
Capacity to Orchestrate the Players
Iterative Process
Planning, Needs Assessment & Analysis
Systems Design & Development
Change Management & Leadership
Continuous Evaluation & Assessment
Required Resources: Time, Money, & Political Finesse

Figure 3. Leadership model and required resources for education reform.

So what can be concluded about SY2000? Many believed SY2000 was merely ahead of its time. Following are comments reflecting this perception. A former State of Florida Education Officer said, "SY2000 left an impact. SY2000 was the beginning of *The Change* and it got the rhetoric to the future change. It was a catalyst for Florida to bring about change. SY2000 never died: its funding was terminated. SY2000 was a flag for *'Here is Education Reform'*. I believe SY2000 was the kick start for education reform; however, it got politicized, and funding was eventually terminated."

Conclusion

What lies ahead for education reform? Does education need merely reform or an entire re-creation? Has the shift from teaching to learning-centered education created a purpose for change? Has technology brought new ideas and opportunities for teaching and learning, as we have never seen before? These changes result in paradigms, therefore what are the solutions for these new paradigms? And what change is required to align education with these new mindsets and directions?

Summary

The outcome of this research study was the presentation of SY2000 sponsors' and advocates' perceptions of what happened during SY2000, what they thought should have happened, and what they wished would happen in future education reform efforts. These individuals were selected based on their leadership or influential roles and positions held during SY2000.

What were the successes of SY2000? I believe SY2000 participants understood the value of a systemic approach to educational reform. There were none whom I surveyed or interviewed that questioned a system design for education reform. On many occasions I heard that SY2000 was brilliantly conceptualized and designed. From all that I heard and read, I believe SY2000 opened many minds to view education as a system comprised of subsystems and mere "tweaking" of subsystems would not make for sustained change or reform.

Another success of SY2000 was the introduction to change management concepts and principles. Many agreed that change was a process, not an event. It was believed that moving from the status quo to the ideal vision required strategic and tactical operations. Respondents welcomed what they were learning about change and how and why people make the transition from "what is" to "what should be."

However, with success of SY2000 came failures. The failures of SY2000 were often missed opportunities or lack of understanding or expertise to anticipate possible outcomes. SY2000 leaders underestimated the significance of vision, buy-in and sustained commitment for SY2000 to be deemed successful. Over time, if those involved were not continuously educated to where they were in the change process, interest and commitment faltered, and was eventually lost. This was the case with sponsors, advocates, and CSD participants.

Legislators should have better realized the value of time and research and development as resources for embarking on a massive and complex reform effort such as SY2000. One can't expect results of an unfinished research-based intervention. However, SY2000 should have built in incremental successes or measurable results that could have been perceived by sponsors and advocates as successes to gain and sustain buy-in and commitment.

Without doubt, SY2000 should have better developed the required synergistic partnerships among the differing cultures. From hearing the different perspectives of government, K-12, and university respondents, I find this to be the main demise of

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SY2000. Education of these individuals and groups was crucial for vision, buy-in, and commitment. I believe all three shared the vision of SY2000, however I question whether they shared an agreement on how it was to be achieved and measured.

And probably the greatest lesson learned from these successes and failures or missed opportunities was realizing the importance that learning must precede change. This learning is the cornerstone or bedrock for getting people to come together, work together, and stay together. Learning depends on open communication and collaboration. Both are built on developing trust to solve problems together and having respect for the power of the whole being greater than the sum of its parts.

Limitations of this Research Study

There were two key limitations to this research study: time and resources. There was not enough time to explore the relationships between other SY2000 change participants and sponsors and advocates (i.e., change agents - CET design team leaders and participants, school principals, district staff; and change targets - SY2000 teachers, instructional support staff, students, and families).

In addition, there was not enough time, travel funds, or political clout to gain access to (or obtain the inputs of or feedback from) Florida State Senators or State and DOE Commissioners of Education who were in office during the SY2000 years. The lack of time also limited the breadth and depth of this study to obtain a broader and sharper image. I would have liked to pursue making contact with some of the individuals who did not respond to mail, email, or telephone requests. I believe due to current sensitive issues regarding politics and education issues (e.g., vouchers, charter schools, accountability, and testing/assessment, university and college restructuring, and skeptical public perception of education in general), I would have had to secure others' support to gain access to some individuals.

Future Research in This Field

Future research in the field of large-scale education reform should investigate the role of change management and change creation in the diffusion of an education innovation or initiative. Action research should validate systematically planned, designed, developed, implemented, and evaluated reform efforts that are based on the change frameworks and methodologies outlined by Conner (1992), Lick and Kaufman (2000), and Ely (1996). In addition, future research should investigate the role and impact of leadership during diffusion of an innovation in an educational setting (e.g., knowing whom to turn to for support and resources – information, time, money, people). I suggest further study to find ways to eliminate communication voids when revolving sponsorship is inevitable.

I suggest further research to validate Lick's *Universal Change Principle*, learning (both as a verb and noun) must precede change, by applying it to the diffusion of an implementation and evaluating it in terms of cost and benefit value. Such a research study could examine and validate ways to educate sponsors, advocates, change agents, change targets, and stakeholders on the strategic and tactical approaches to change creation and implementation (Conner, 1992; Lick & Kaufman, 2000).

Finally, future research should consider an in-depth examination of the impacts from a large-scale education reform on other key change roles, the change agents (e.g., innovation design team leaders and participants, school principals, district staff) and change targets (e.g., teachers, instructional support staff, students, and families).

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The Impact of Mobile Computers in the Classroom – Results From an Ongoing Video Study

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Abstract

Since the early 1990's, laptop computers have repeatedly been suggested as a tool to improve instruction and student learning. Meanwhile, several evaluations have shown that laptops helped to increase the amount of independent and collaborative learning. Instruction with laptops was also found to be more student-centered in many cases. However, most of these studies are based on subjective data (interviews and questionnaires) exclusively. Observational data to confirm these findings is missing. The present study examines 45 lessons (24 with and 21 without laptop use) that where videotaped over the course of 2 ½ years in a laptop program of a German high school. It is found that when laptops are used, the use of other instructional media, particularly notebooks and the blackboard, decreases significantly. The amount of independent work is found to increase significantly, while for other forms of instruction, such as teamwork, pair work, lectures and teacher-guided discussions no differences can be determined. The results are discussed in relation to interview and survey data gathered in the same study.

Introduction

Many studies have shown that computers at school can have a beneficial effect not only on student achievement but also on students' learning motivation, on classroom atmosphere, and on the teachers' willingness to experiment with new and innovative instructional approaches (Christmann, Badgett & Lucking, 1997; Dwyer, 1994; Kulik & Kulik, 1991; Liao, 1992; Losak & MacFarland, 1994; Sivin-Kachala & Bialo, 1996). Yet, it is often lamented that schools are reluctant and slow in integrating computers and in adapting to the needs of the information society (e. g. Peck & Dorricott, 1994). Studies found that the schools' computer equipment is often used inadequately or not at all (Marcinkiewicz, 1993). One reason for this might be that most school computers are desktop machines located in computer labs, which cannot be used flexibly when needed and cannot be used outside school (Fabry & Higgs, 1997). Obviously, in an arrangement like this, computers cannot become the natural tool for learning that is so often called for.

The use of mobile computers is often suggested as a possibility to solve this problem. Only if every student and every teacher had his/her own laptop computer, say proponents of mobile computers, information technology in education could be used to its full effect. Therefore, the introduction of laptops to the classroom is seen as a major catalyst for a profound change in learning and instruction in K-12 as well as in higher education (Owen & Lambert, 1996; Robertson, Calder, Fung, Jones & O'Shea, 1997; Stager, 1995).

Since the start of the Microsoft „Anytime, Anywhere Learning" initiative in 1996 (to name only one of numerous sponsoring programs), the use of mobile computers has spread worldwide and several extensive evaluations have been carried out (e. g. Bruck, et al., 1998; Fouts & Stuen, 1997; Hill & Reeves, 1999; Rockman et al., 1998; Stevenson, 1999). With regard to instructional strategies and classroom practice, some of these studies found that phases of independent work as well as project work increased (Fouts & Stuen, 1997; Rockman et al. 1998) or that teachers felt that laptops were particularly suited to this kind of work (Bruck et al., 1998). Studies also repeatedly showed that there was more extensive collaborative learning in the laptop classrooms (Bruck et al., 1998; Fouts & Stuen, 1997; Rockman et al. 1998) and that students liked to help each other as well as their teachers with laptop problems (Bruck et al., 1998; Rockmann et al., 1998). On the other hand, it was also found that technical problems often hampered the successful use of laptops in the classroom (Bruck et al., 1998; Robertson et al., 1996, Rockman et al., 1997). In addition, Bruck et al. (1998) reported that some teachers deplored a high level of student distraction, as well as the loss of authority and control in the laptop classroom.

Overall, it seems that many of the positive expectations that are associated with the use of mobile computers in school could be confirmed in recent studies. However, the studies referred to above are tainted with various problems: First, the results are mainly based on questionnaire and interview data exclusively, which is known to be biased in several ways (Bortz & Döring, 1995). Behavioral and observational data to confirm the self reported data is missing in most studies. Also, many studies did not investigate control groups so that the effect of the laptop computers is not clear. Finally, results are sometimes based on rather short observation periods (ranging from a couple of weeks to 2 years at most) and small student samples.

Background of the study

In March 1999, one of the first laptop programs in Germany started at the Evangelisch Stiftisches Gymnasium Guetersloh. More than 300 students of this high school and their teachers were gradually furnished with networked laptop computers. Students of four cohorts entered the program in grade 7 and are using laptops regularly at school and at home until the end of grade 10.

The school's administrators, participating teachers and parents have developed an elaborate pedagogical concept for the integration of laptops, which is based on the school's three general assumptions about the benefits of incorporating media in instruction: Media are essential to foster students' media literacy, they can serve as a tool to connect the classroom to the authentic world outside school and they are a valuable means to improve instruction (Engelen, 2000; 2001a, b). With regard to the improvement of instruction, the concept draws from a reform-pedagogical framework that states that media should be used to

- foster the concreteness and vividness of instruction,
- facilitate individualized learning and intensify phases of student work
- strengthen teamwork and communication in the classroom
- increase the amount of independent learning and problem solving
- further students' responsibility and improve their attitude toward co-operation and sense of belonging to the school community

This framework provides the foundation for the school's concept of laptop learning. Teachers jointly develop instructional units based on these reform-pedagogical ideas, making sure that the computers are used to serve a sound didactic purpose. Important cornerstones of the concept are also that the computer is integrated into the regular curriculum from the very beginning and that the frequency of use of the laptops is increased step-by-step, starting with only one subject and gradually expanding to the whole curriculum within the first project year.

An extensive evaluation that is carried out by the Center for Media Research, Freie Universitaet Berlin accompanies the pilot project. The evaluation focuses on changes in instructional strategies and classroom practice, student achievement in selected subject areas and the acquisition of cross-curricular competencies (an extensive report will be published in 2002 by the Bertelsmann Foundation, one of the main sponsors of the project). This paper presents preliminary results regarding the first aspect, instructional strategies and classroom practice.

Method

To overcome the shortcomings of other studies pointed out above, observational data was gathered to investigate changes of teaching strategies and classroom practice. A randomly selected sample of lessons of the laptop classes was videotaped over the past 2½ years. The same classes and the same teachers were recorded repeatedly. As the laptop classes are not using their computers every day, lessons with and without laptop use could be recorded in the same classes with the same teachers. Confounding effects that result from comparing different classes or teachers with different teacher styles, could thus be reduced. Subjects covered are mathematics, German, and English.

A body of 45 lessons was videotaped. 24 of these were laptop lessons, 21 were lessons without laptop use. Table 1 provides an overview of the distribution of lessons.

Table 1: Distribution of lessons with and without laptops

			Grade			Total
Laptop			Grade 7	Grade 8	Grade 9	
With Laptop	Subject	English	4	3	1	8
		German	5	4	1	10
		Maths	3	2	1	6
	Total		12	9	3	24
Without Laptop	Subject	English	4	1	-	5
		German	5	3	1	9
		Maths	2	3	2	7
	Total		11	7	3	21

The lessons with and without laptops have so far been compared for use of instructional media and form of instruction. Every lesson was divided into a maximum of nine intervals of 5 minutes length. For each interval, two trained observers recorded the dominant media use and form of instruction. The inter-rater agreement, as determined with the intra-class coefficient, was .93 for the use of instructional media and .79 for the form of instruction.

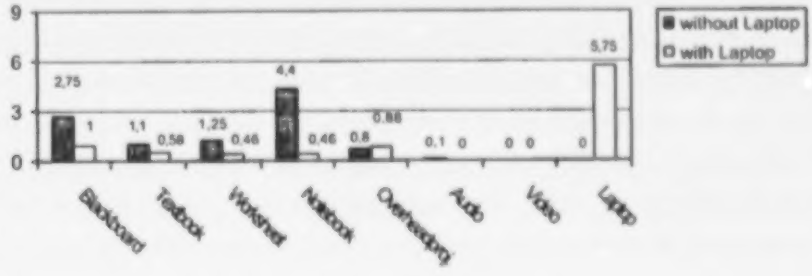
The results of the video study are discussed in the light of data gathered from student surveys and qualitative interviews with teachers and students in the last section of this paper.

Results

Use of Instructional Media

On a descriptive basis, it was found that the use of the laptop had a decreasing effect on the frequency of use of "traditional" instructional media, such as textbook and worksheets, blackboard and notebooks (see Fig. 1).

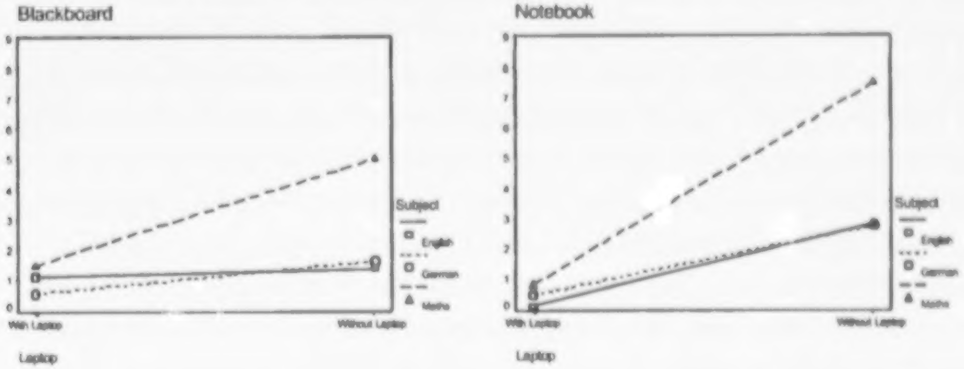
Fig. 1: Media use (number of 5-minute intervals) in lessons with and without laptops



The difference between laptop and non-laptop lessons was tested with a multivariate two-factorial analysis of variance with laptop use and school subject as fixed factors. The dependent variables were the frequencies of instructional media use. A significant main effect was found for the factor laptop use (Wilks's Lambda = .10; $F(7,32) = 40.04$; $p < .01$). An analysis at the univariate level showed that the frequency of use of the blackboard ($F(1,38) = 9.62$; $p = .04$), notebook ($F(1,38) = 52.37$; $p < .01$) and of course laptop ($F(1,38) = 214.48$; $p < .01$) was significantly different between laptop and non-laptop lessons. The frequency of use of worksheets tended to be significant ($F(1,38) = 3.72$; $p = .06$).

The interaction of laptop use and school subject tended to be significant at the multivariate level (Wilks's Lambda = .53; $F(14,64) = 1.69$; $p = .08$). A subsequent univariate test indicated that there was a significant interaction for the use of the blackboard ($F(2,38) = 3.32$; $p = .05$) and notebook ($F(2,38) = 6.60$; $p = .03$). The interaction plot is depicted in Fig. 2. It can be seen that there is a particularly sharp decrease in the use of the blackboard and of notebooks in mathematics, while the difference is much less distinct in the two other subjects.

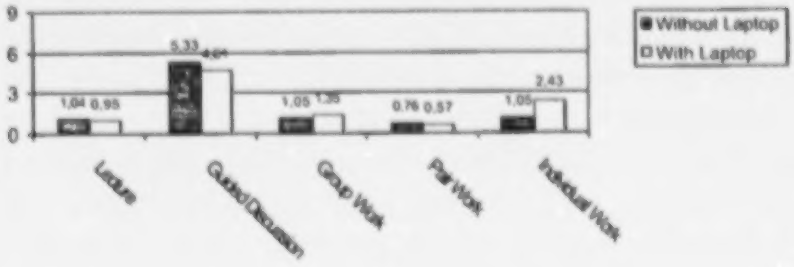
Fig. 2: Interaction plots for blackboard and notebook



Form of Instruction

For the form of instruction, the descriptive analysis showed that guided discussions are the most prominent form of instructional activity both in laptop as well as in non-laptop lessons (see Fig 3). Laptop lessons differed most strongly from non-laptop lessons in that students work individually more frequently. Qualitatively, it was interesting to note that phases of individual work were often longer when the laptop was used than in non-laptop lessons. Group activities were also observed slightly more often in laptop lessons than in non-laptop lessons and tended to be more project-based, while group activities in traditional lessons were shorter exercises that could be solved in a limited amount of time, typically within the respective lesson. The frequency of lecture and pair work is almost identical in laptop and non-laptop lessons.

Fig. 3: Form of instruction (number of 5-minute intervals) in lessons with and without laptops



The difference between lessons with and without laptop use was again tested with a two-factorial analysis of variance with laptop use and school subject as fixed factors and the five forms of instruction as dependent variables. A significant main effect was found for the factor laptop use (Wilks's Lambda = .71; $F(5,34) = 2.82$; $p = .03$). At the univariate level, only the frequency of individual work was found to be significant ($F(1,38) = 10.82$; $p < .01$) while the other differences could not be statistically confirmed. The interaction of laptop use and school subject was not significant (Wilks's Lambda = .73; $F(10,68) = 1.16$; $p = .33$).

Discussion

The differences in the use of instructional media in laptop and non-laptop lessons show that the computer primarily takes over the function of the notebook. This finding corresponds with the statement of students and teachers in questionnaires and interviews that the laptops are most frequently used as a writing tool. However, this does not mean that the laptops are simply used as an "electronic notebook". In fact, especially in the teacher interviews it is emphasized that using an electronic writing tool enhances the use of the traditional notebooks in several ways: Most importantly, the possibility to easily change and edit text is seen as a tremendous advantage of the laptops for introducing students to the process of writing. It helps to encourage them to critically analyze their own and their classmates' texts and improve them by revising and re-writing them multiple times. Also, some teachers say that writing electronically motivates reluctant writers and many students stated that writing with the laptops was fun and one of their favorite activities. In addition, the laptops are used to create archives for certain subject matter (e. g. an English grammar archive or a Mathematics archive) with entries that are electronically linked. These archives are continually expanded throughout the years. Both, teachers and students said that the archives have many advantages in comparison to traditional notebooks, as they have a more transparent structure, new entries can easily be connected to existing entries, they do not get lost and some students found that they are better suited for revision and learning. Finally, teachers and students stated that co-operative writing tasks could be carried out much easier with computers.

Another remarkable difference in the use of instructional media is that the blackboard was used less often in laptop than in non-laptop lessons. This may indicate that instruction in the laptop lessons is less teacher-centered as the blackboard is typically used in teacher-guided phases. The teacher interviews confirm this interpretation as teachers said that when they teach with laptops they often do not teach the whole class but interact with individual students while the class is working on a problem individually or in groups. However, the analysis of the frequency of lectures and teacher-led discussions in laptop and non-laptop lessons weakens this assertion (see below).

Regarding the school subjects, the clearest difference in the use of instructional media was found in mathematics. Mathematics was found to be the subject that makes most extensive use of the traditional media notebook and blackboard in non-laptop lessons. Thus, in terms of instructional media use, it is impacted most profoundly. However, subjectively, the change is felt similarly in all subjects, as the observations from the interviews referred to above were comparable across subjects.

Regarding the form of instruction, the differences between lessons with and without laptop use are less clear. Phases of individual work increased. This corresponds to the pedagogical concept of the school on the one hand, as the laptops were to be used to facilitate individualized learning and intensify phases of student work and to increase the amount of independent learning and problem solving. It also confirms the statement of the teachers in teacher interviews that they use the laptops to activate the students and often employ them for individual work to make sure that every student acquires computer literacy, which is one of the main goals of the project.

The frequency of teacher-led discussion decreased in laptop lessons. However, the difference in comparison to non-laptop lessons was not significant. This difference was felt to be much stronger in the teacher interviews, where a majority of teachers stated that instruction is becoming considerably less teacher-centered when laptops are used. The video observation shows that just like in traditional lessons, guided class discussions are still the most prominent form of instruction in laptop lessons. Also, the amount of lectures was almost identical in laptop and non-laptop lessons.

Moreover, the frequency of group work did not differ strongly between laptop and non-laptop lessons. This result is partly confirmed by student surveys as two of the three cohorts reported only a slight increase of group work or even a decrease of group work. Teachers held varied opinions on whether they had students do more group work when laptops were used. Especially some teachers of the first cohort experimented extensively with teamwork and carried out several student projects. Experiences were mixed, as students were partly overwhelmed when they worked on projects in multiple subjects at the same time. In the following years, project work was therefore reduced. Some teachers of the second and third cohort reported that they do not use group work more often than in regular instruction. Yet, students as well as teachers unanimously reported that they felt that laptops are a valuable tool for teamwork and that working collaboratively is easier with laptops than with traditional media.

Conclusion

The results show that the major change in the laptop classroom is an increase in individual work. Students work more often independently, which according to many teachers, results in a higher degree of activation than in traditional lessons. In contrast to other evaluations mentioned earlier, this study could not unequivocally confirm that using laptops led to more collaborative classroom activities. Even though strengthening teamwork and communication in the classroom is one of the declared pedagogical goals of the project, there was no clear general increase in group work. It seems that while extensive group projects have been carried out with the laptops, this was rather the exception than the rule. If only subjective data had been gathered, these projects could have easily been overemphasized. The same is true for the change from teacher- to student-centered instruction. While there are clear indications that the laptop classroom is becoming more student-centered, the video analysis also shows that the change is less profound than only looking at the subjective data might have suggested.

The use of video proves to be a helpful tool to corroborate findings that are based on subjective data. Results, which were derived from questionnaires and interviews, could be confirmed through observation in many cases, thus raising their credibility. While it should not be concluded that one source of data has more value than the other, this study shows that combining observational and survey/interview data is worthwhile to enhance the validity of a study's results. It reduces the danger of misinterpreting findings and helps to detect possible biases in subjective reports.

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AECT Advanced Program Standards and Web-Based Portfolio Development

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Abstract

An instructional approach for conceptualizing the five domains of the instructional technology knowledge base defined by AECT Initial and Advanced Program Guidelines —design, development, utilization, management and assessment—that were required to be integrated into professional electronic portfolios developed by educational technology degree candidates is examined. An in depth look of the process is provided through quantitative and qualitative data about the students' perceptions of the utility of the AECT domains for communicating their professionalism in their portfolios. The process is further examined through the lenses provided by five departmental faculty members' qualitative assessments of the students' portfolios and the students' presentations of these artifacts. Results of this preliminary study indicate that although the five domains tend to be valued for their usefulness in designing to express emerging professionalism, unless required, most would not employ them. Once applied, however, most would retain this framework. Additional suggestions for modifying the portfolio design and development process from initiation in a web-based course towards the beginning of the students' course of studies through to the final presentation at the conclusion of their program are offered. The increased emphasis on portfolio development throughout education, the growth of web-based design, and the acceptance of the AECT Guidelines for candidates in both Basic Media Technology in Teacher Education and Advanced Programs in Educational Communications and Technology by the Council for the Accreditation of Teacher Education (NCATE) suggest continued study. Such study is especially warranted in terms of the potential for providing learner guidance relative to this area for students enrolled in educational technology programs.

Introduction

The Accreditation Committee of Association for Educational Communications and Technology (AECT) provides Folio Review Guidelines related to educational technology. The guidelines include Basic Guidelines for Media Technology in Teacher Education, as well as for Advanced Programs in Educational Communications and Technology (Association for Educational Communications and Technology, 2000) that are accepted by the National Council for the Accreditation of Teacher Education (NCATE). These guidelines provide a systematic means for internal and external program reviews at colleges and universities throughout the United States.

Standards in Education

In this twenty-first century such an emphasis on standards for education is not uncommon. Examples can be found relative to overall professionalism for teachers (National Board for Professional Teaching Standards, 2001), specific Standards for Technology in Teacher Preparation (International Society for Technology in Education, 2001), and specific content areas, such as standards for mathematics (National Council for the Teachers of Mathematics, n.d.).

Standards in Educational Technology

In the field of educational technology, candidates in both entry level and advanced programs are expected to acquire knowledge and skill within five main areas of the instructional technology knowledge base in domains of: design, development, utilization, management and assessment. Within advanced programs, candidates should demonstrate minimal competencies within each area along with advanced capability in aspects specifically emphasized by the program at their institutions.

Web-Based Delivery of Instruction and Professional Portfolio Development.

Additionally, two other areas that impact educational technology majors are web-based delivery of instruction and professional portfolio development. These students may acquire some of their capabilities through web-based coursework. Educational technology majors, as current and future teachers or trainers, may be expected to teach by means of the World Wide Web (WWW). Experience with this mode of learning is essential for their future distance learners and for their colleagues when they function as consultants. Furthermore, these majors are increasingly expected to demonstrate their knowledge and skills at the completion of their program of studies in electronic portfolios.

Professional Electronic Portfolios

Professional electronic portfolios would appear to be an integral part of the core concepts of post-modernism that Solomon (2000) relates to instructional technology. Professional portfolio development supports: 1) respect for differences and multiple explanations through inherent nonlinear design; 2) construction of personal views by prospective employers and others through text, audio, and visual information about the candidate; 3) critical evaluation as candidates assess themselves at the design phase; and 4) expression, to some extent, of the complexity of the system of educational technology as hypermedia links to design, development, utilization, management, and evaluation aspects and to candidates' professionalism and theoretical constructs of the field. Additionally, development of Web-based electronic portfolios is growing at all levels of education (Sanders, 2000).

Web-Based Course, Program of Studies, and Web-Based Production

At a department of educational technology at one Pacific-based university, graduate students participate in a totally Web-based course on newer technologies. Typically, they enroll in this course in their first or second semester in the program. The Web-based delivery mode of this course with its multilevel, hypertext structure and design for interactivity with the learners by synchronous and asynchronous communications, text, audio, and graphic display (Chu 2000) offers a supportive context for core concepts of postmodernism.

Along with earning 39 graduate level credits in required and elective courses, completing 6 credits in prerequisite courses, engaging in both a collaborative and individual practicum, and carrying out a comprehensive master's project, these students were recently required to also produce a professional electronic portfolio during their program of studies. Introduction to this portfolio process was incorporated in the required Web-based course that addresses basic concepts of instructional design and multimedia authoring. Typically, students enroll in this course during their first or second semester of study. In following this newer departmental process for developing this Web-based multimedia perspective about themselves, they continue the process throughout their program. As currently designed, after the initial course, consultation with peers and advisors about their continued development of their portfolios occurs primarily when initiated by the student. During a culminating course, they do have the opportunity to critique each other's work prior to formally presenting their completed portfolios to the faculty.

When this project was first instituted, students studied multimedia design principles (Park and Hannafin, 1993) and addressed general guidelines for content broadly described to encourage individuality of expression. At the conclusion of the course, initial portfolios were assessed in terms of effective design and plan for content coverage. An initial investigation of the students' work indicated that, although they demonstrated competencies in all five domains that define an educational technologist, they did not tend to overtly conceptualize their expertise within this framework. Many communicated their capabilities in terms of courses, which may or may not be meaningful to future employers (Sherry, 2000).

Problem Statement

Although faculty in educational technology programs, particularly those members engaged in the NCATE process, may become adept at describing their programs and their candidates' capabilities in terms of these domains, how might their students begin to conceptualize their leaning within this framework? Presenting their competencies in this manner could offer potential employers and their graduate faculty a consistent, professional view of their expertise in these critical areas in relation to standards set by a professional association.

As these findings emerged, departmental faculty members decided to disseminate information about the domains and the framework for the portfolios as the students were developing their initial portfolios in the Web-based course. They followed up with a print-based reminder as the students advanced toward completion of their portfolios prior to graduation. These students earn the required minimum of 39 credits in courses in areas specific to these domains and in specific related aspects of educational technology. As students who are used to developing and analyzing instructional designs in a structured manner, it became essential to evaluate their perceptions of the utility of, and type of integration of, this structured framework for expressing their nascent professionalism.

Methodology

An investigation was, thus, undertaken as a preliminary evaluation study.

Ethical Practice and Participants

This examination, construed as standard educational practice, received the anticipated exempt classification after review by the Institutional Review Board Committee for the Protection of Human Subjects at the university where the study was conducted. In compliance with that process, all participants were fully apprised in writing of the nature of the study, their option for voluntary participation, and their option to participate in having examples of their work displayed as results of the study were disseminated. Of the eight students who completed portfolios prior to graduation, seven agreed to participate in the study. The resulting 88% return rate, represents five of the six females and both of the males; an acceptable rate to provide an initial perspective of the perceived usefulness of the five domains for communicating professionalism as educational technologists through the medium of electronic portfolios.

Data Gathering

Data are based on quantitative and qualitative responses from, and the actual portfolios created by, participants and on qualitative data from their faculty members.

Survey Instrument.

As no published survey was identified that addressed the questions being studied, a written survey was developed. Questions designed to capture demographic data about gender, employment, planned portfolio usage, experience producing portfolios prior to creating these professional portfolios, and awareness of the five domains of an educational technologist were included in the survey. The students' views of the usefulness of the five domains were operationalized in terms of five constructs. The five are the utility of employing the domains in their portfolios for communicating: 1) the students' knowledge, 2) the students' skills, 3) the range of the students' professionalism, 4) the contribution the domains made to the students' descriptions, and 5) the students' intent to retain the domains in their portfolios after graduation. Their reactions to these five aspects were captured on a ten item survey that has a negatively and positively worded item for each aspect.

The Loyd and Gressard (1986) Computer Attitude Survey consisting of 40 positively and negatively worded items about attitudes toward computers served to guide the construction of these types of questions. For example, the two items about perceptions of skills appear as, "The 5 domains are useful in my electronic portfolio in describing my skills in the field of educational technology" and "My skills can be described better if descriptors other than the five domains are used." A graduate student in the program also offered one-on-one feedback about the survey during its construction.

Students indicated their degree of agreement on a four point Likert-like scale that ranged from "strongly agree" to "strongly disagree". In addition, five open-ended questions were developed to obtain input about the type of examples that students' selected for their portfolios when expressing their performances in each of the five domains of an educational technologist. A final broad, open-ended question sought additional comments.

Artifacts.

The students' electronic portfolios also served as a means of verifying application of the domains.

Faculty Responses.

The five full-time departmental faculty members also provided oral input after viewing the students' formal presentations of their portfolios. The relatively small size of the department (5 full-time faculty members and c. 50 master's degree candidates) did not permit the separation of the investigator as a participant.

Data Analysis

During analysis, an emphasis on the more objective data—the quantitative responses from the students—and validation of the faculty members' judgements expressed as emergent themes about the students' portfolios and presentations were confirmed by all the faculty members. This approach was taken to mitigate to some degree any potential for bias that might occur from the close association between the primary investigator and resulting interpretations of the data. Despite the small numbers of participants, the multiple sources of data collected in this study do have potential to offer an initial view of a process that others may wish to employ to some degree as they engage in similar efforts.

Quantitative Data

Quantitative data were analyzed in terms of frequency distributions. From those analyses the picture that appears shows that among the seven respondents who provided usable data, two were unemployed prior to graduation, four were working as graduate assistants in a technology support capacity, and one was employed in a network security role. Five had had no experience producing any type of portfolio prior to initiating work on their professional electronic portfolios for their master's program. All of the participants indicated that they only become aware of the five domains of an educational technologist as they completed their electronic portfolios.

To more readily express the sentiments of the limited number of participants, the "strongly" and "slightly" agree categories for both agreement and disagreement were collapsed into two categories of agreement and disagreement.

As indicated in Figure 1, the five domains are viewed as contributing to the communication of knowledge and skills as an educational technologist by six of the seven respondents for the former aspect and all of the students for the latter one.

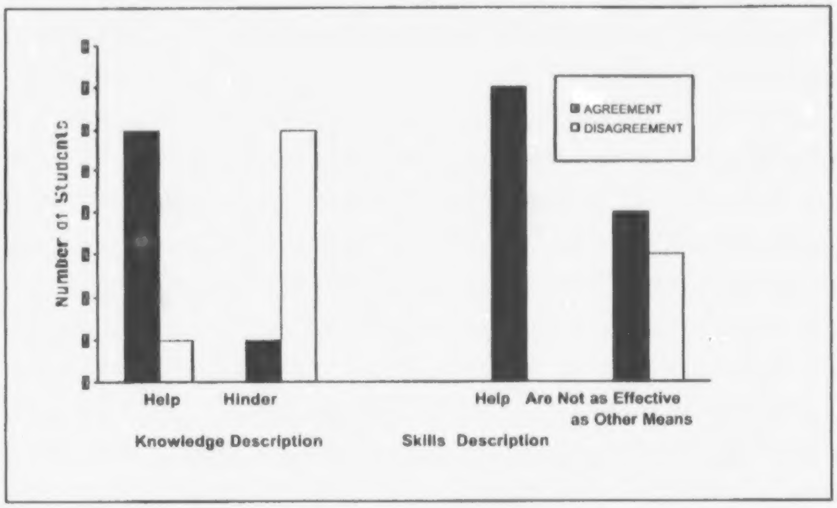

Figure 1. Perceptions of the usefulness of the five domains of an educational technologist when conceptualizing professionalism as an educational technologist in a professional electronic portfolio.

Despite the positive regard for applying the domains to describe skills, negativity predominates (n=4) in regard to the domains being used for skill description rather than some other means.

Figure 2 reflects students' responses to the picture of the domains, and the perceived contribution to professionalism, as well as, to confusion during use. For expressing overall professionalism, all but one of the respondents view the domains as being helpful and not hindering such a depiction. Most (n=5) view the domains as contributing to depicting their range of capabilities. The same number, however, do agree that during production the domains are confusing to use.

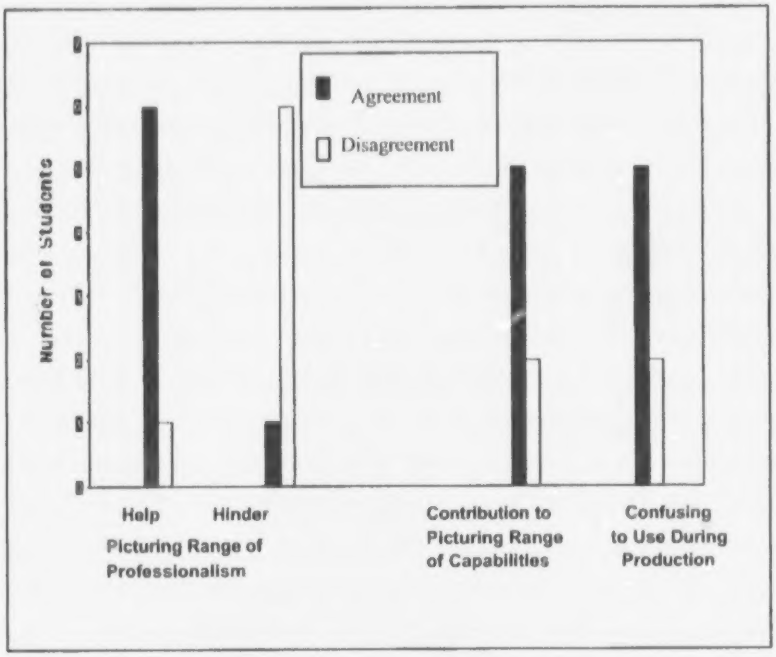

Figure 2. Perceptions of the usefulness of the five domains of an educational technologist when conceptualizing one's range of professionalism and as an educational technologist and of the contribution that the domains made to this picture in a professional electronic portfolio.

That same number of students state they would not employ the domains if they were not required to do so, although five of them do plan to retain usage of the domains (see Figure 3).

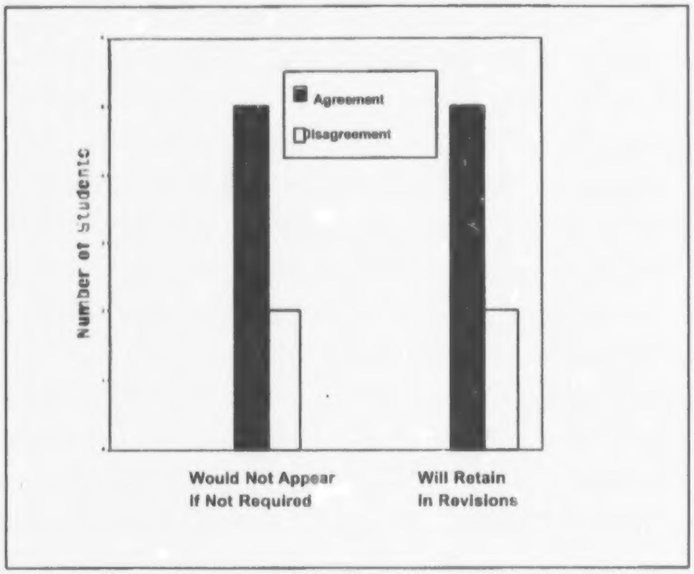

Figure 3. Perceptions of plans to retain the five domains of an educational technologist to communicate professionalism as an educational in a professional electronic portfolio.

Students' Qualitative Data

Six of the seven respondents completed the open-ended section of the survey that related to the manner in which they conceptualized the examples they selected to represent their professionalism for each of the five domains. Half briefly referenced their selections. Each domain, for example, is expressed in the following manner: for design, "Grant from ETEC 600;" for development, "ETEC 603 Designing a paper-based module;" for management, "ETEC 650 assignments;" for utilization, "ETEC 662 Planning a computer lab (networking)"; and for evaluation, "final project" [master's study]. Of those respondents who expressed their choices in this manner, they referred specifically to nine courses, five of which are required courses in the master's degree program.

The other three respondents offered brief narratives about their knowledge and skills, rather than referencing a course alpha and number. For example, in relation to the domain of design, one student wrote, "Print-based instructional module—surfing lessons" This instructional module was designed following the Dick & Carey instructional design model." A similar example, in relation to the domain of management is expressed as,

> A visit to UHM video (on Products Page) based on Mintzberg's (1971) principles of mgmt. I was the director of the video. I served as the liaison between the various actors groups for resources & communication. I was resource allocator & the negotiator in that I made sure the project was recorded, edited, & turned in on time.

Analysis of Portfolios

A review of the portfolios themselves by all the departmental faculty members indicates that all the students completed their portfolios, addressing design and content requirements to a degree deemed acceptable for this newer departmental requirement.

Comparison of Faculty Members' and Students' Qualitative Data

Qualitative data, the students' responses to the open-ended questions, their actual portfolios, and the faculty members' oral comments about the portfolios were analyzed in terms of emergent themes.

Emergent themes during the analysis of the open-ended comments offered by both the students and the faculty members indicate that, although there is some convergence in regard to the issues, students' comments relate primarily to learner guidance about the domains. Specifically, they mention the need to provide information about the domains at the beginning of the process with details about the domains as they develop their portfolios. There are suggestions related to the format that the guidance could assume, such as, a brochure about the domains and examples of portfolios that integrate explicit domain-based information.

To some extent the feedback from the faculty members reflects the students' ideas. The faculty members' note the need for the candidates to be clear and overt in explanations about the domains in their electronic portfolios. To achieve such ends and overall professionalism in portfolios, the faculty members cite a need for a more structured ongoing peer and faculty feedback process during the two plus years of design and development.

In terms of professionalism, the faculty members state that such posture needs to be emphasized in the design and selection of content. They explicitly note this situation in terms of the degree of emphasis given to work-related information over personal data; selection of concise exemplars; use of sophisticated design elements, including decisions about selecting appropriate graphics; and increased focus on the candidates' future worth. Formatting is also mentioned with recommendations for the inclusion of alt tags and pdf files to ensure that awareness of ADA and printing concerns are conveyed.

Of particular note is a reminder to address privacy issues in terms of self and others, such as considering the amount of personal information to make readily available on the WWW and obscuring references to specific individuals, or educational sites, that might occur in samples included in the portfolios. They also call for developing a way for the students to communicate the rich content of these portfolios in a reasonable timeframe, while ensuring professionalism during presentation.

Discussion

Despite introducing the concept of analyzing professional knowledge and skills and overall range of professionalism in relation to the five domains of their field toward the completion of the portfolio process, it is encouraging to note the students' overall positive reaction to the utility of that framework. The process of synthesis required of them, rather than analysis, can be a more challenging intellectual skill. This cognitive demand may be reflected to some extent in the students' mixed feelings about the contribution that the domains make in conveying the range of the students' capabilities.

Perceptions of Domains

Although they primarily agreed (n=5) that the domains did contribute to this picture, the same number also noted that during production the domains were confusing to use. Their comments about the need for additional guidance in regard to the domains, particularly their request for brochures and examples from the portfolios of others, offer support for providing additional information for future learners both about the domains themselves and about applying them to interpret and communicate their capabilities.

At first it might appear that the students do not value the domains as descriptors, as the majority of the students (n=5) indicate that they would not employ them unless required to do. Their acknowledgement (n=5), however, that they plan to retain the domains as descriptors during revisions appears to reflect the worth which they apparently are beginning to place on the domains. A review of the final versions of the portfolios at graduation, when minor revisions were made after the formal presentations also supports this contention.

Expanded descriptions provided by three of the students in regard to addressing each of the domains in their portfolios, as opposed to the other students' succinct references to course alpha and numbers, suggest a deeper integration of the concepts by the former. The reason, however, is not evident from data gathered in this study.

Process Issues

Instructional design issues, thus, are the predominant concerns identified by responses to the survey, in the actual portfolios, and in the faculty members' evaluations. Contextual issues related to resources—hardware and software accessibility—did not appear in any comments other than a reminder from the faculty members about ensuring that the required CD-ROM copy of the portfolios continue to be made to ensure that the students' work not be lost in "cyberspace." The absence of concerns about hardware and software where not surprising. As majors in an educational technology program, personal ownership of a computer is expected. Additionally, generous, successful grant funding has resulted in a relatively high-end technology laboratory being available not only for these majors, but for all in the college of education.

Implications

The students do offer perspectives that indicate their awareness of, as well as the usefulness of, incorporating the five domains into their portfolios, as well as a variation in the level of conceptualizing domain usage. As professionals in the field of educational technology, planning for effective transfer of critical learning experiences is an essential part of their learning. The results of this preliminary investigation about graduate level educational technology students' perspectives of engaging in the electronic portfolio process and their depictions of themselves as designers, developers, users, managers, and evaluators in terms of these five domains suggest future directions for faculty members in similar situations.

Incidental information related to candidates' portfolio development offers a glimpse of the potential connection that might result from the students' efforts in designing and developing their portfolios. Based on a recent summary of Kirkpatrick's classic Four-Level Evaluation Model from the late 1950's (2001), at Level One, Reaction, the participating students hold predominantly positive attitudes toward the utility the domain-centered framework provides. At Level Two, Learning, they appear capable of communicating their knowledge and skills in relation to the domains. A slight suggestion of how Level Three, Behavior on the Job, is offered in terms of most students indicating that they plan to retain the domains as descriptors in future revisions of their portfolios. It may be that they are planning ongoing usage in future work situations. It is nearly impossible to determine in any substantive manner insights about such portfolio usage in terms of Kirkpatrick's evaluation Level Four, Results, as it refers to impact on the job. Preliminary, incidental data do, however, offer a very faint preliminary sketch. One student nearing graduation, who produced a portfolio before the requirement to overtly address the domains existed, received two university-level job offers within three days of posting his portfolio on the WWW. This outcome resulted despite his avoidance of posting his work on a job recruitment site. A recent student, who incorporated the domains in her portfolio and obtained a position as a lecturer at a two-year college, was told after being selected that her portfolio contributed to the decision to hire her.

The mere suggestion of such impact makes continuing efforts in refining the professional electronic portfolio process, particularly for educational technology majors who are expected to communicate their professionalism using newer technologies, essential. It is particularly critical as the portfolio process, in varying formats, gains increasing attention for pre- and in-service educators in all fields (Campbell, Cignetti, Melenyzer, Nettles, & Wyman, Jr., 2001; Sanders, 2000).

Additionally, scaffolding candidates' professional development is an important theme for virtual universities (Collis, 1997). It may well be that an electronic portfolio development process within the WWW environment, one that is continually scrutinized in terms of the process and output can provide such support for educational technology candidates. Future studies conducted by investigators at institutions of higher education in the United States, as well as ones overseas, that offer graduate programs in educational technology would seem warranted to determine the ultimate value of this intended exemplar of professionalism. Given the time and effort that both faculty and students expend on the process it is critical that such studies occur.

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On-line Support and Portfolio Assessment for NETS-T Standards In Pre-Service Programs at a Large Southeastern University

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.Laurie B. Dias
Georgia State University

Abstract

This paper details the theoretical underpinnings of one university's approach to technology integration in its pre-service teacher preparation programs, and the results of a continuous, feedback-driven project to evaluate for technology integration through a student portfolio development process. Portfolios are assessed for multiple education and technology standards. Results of the project to date as well as future plans are shared and discussed.

Georgia State University received a Preparing Tomorrow's Teachers to Use Technology Grant at the Implementation level during the first year of grant awards. In the first year of the grant, the College of Education, as a whole, worked to put standards and assessment procedures into place to meet state and national technology standards. Due to a reorganization of the project management team prior to the second year of funding, a different approach was deemed necessary to meet the requirements of the grant funding. Mini-grants were awarded to faculty teams to support grass-roots level technology integration projects. This paper reports on the development efforts of one such mini-grant. This PT3 mini-grant had two foci: to continue the development of an on-line support system to assist preservice teachers in meeting the NETS-T standards, and the extension of a portfolio development and assessment process to include assessment for NETS-T standards.

Teacher Technology Integration Skills

Federal, state, and local agencies are investing billions of dollars to equip schools with the technology that may well be the key to improving the learning experience of our nation's youth. Despite these gargantuan investments, only 20 percent of the 2.5 million teachers currently working in public schools feel comfortable using these technologies in the classroom (U.S. Department of Education, 1999; *Technology Counts*, 1997). As reeducating the existing teaching force to take full advantage of these technology tools will require expensive professional development over many years, the preparedness of new teachers entering the field becomes critical to the success of these investments to improve education. As the federal government predicts that 2.2 million new teachers will be needed in the next decade, the time to address these issues is now (Milken Exchange on Education Technology, 1999).

Computer technology has been available for use in educational settings for several decades. According to a survey of U.S. state-level technology officials (Trotter, 1999), 42 states require teacher preparation programs to include technology. One might think that by this time colleges of education (COEs) are successfully preparing teachers to integrate technology into instructional practices. However, this has not necessarily been the case. In 1995, the U.S. Office of Technology Assessment (OTA) published a report on the status of teachers and technology. According to the OTA, teachers were not and did not feel adequately prepared to integrate technology into their teaching practices. One of the contributing factors cited was the lack of technology training available in teacher preparation programs at colleges of education (COE). When technology instruction was provided, it involved teaching *about* technology not teaching *with* technology. In most instances, COE faculty did not model technology integration with their preservice students.

According to a recent survey of 416 teacher preparation institutions commissioned by the Milken Exchange of Education Technology, most faculty members did not model the use of instructional technology skills in their teaching (Moursund & Bielefeldt, 1999). In several studies it appears that faculty who are not modeling are also not requiring students to use technology in their lessons or assignments (Lewallen, 1998; U.S. Congress, 1995; Wetzel, 1993).

However, a report produced by the U.S. Department of Education (2000 revealed refreshing news: less experienced teachers were more likely than experienced colleagues to indicate that college course work prepared them to use computers in their classrooms. "84 percent of teachers with 3 or fewer years and 76 percent of teachers with 4 to 9 years of teaching experience reported that college/graduate work prepared them to use these technologies to any extent, compared with 44 percent of teachers with 10 to 19 years and 31 percent of teachers with 20 or more years of teaching experience" (p. 78). While teacher education programs still face obstacles as they prepare preservice teachers, it is evident they are making in-roads.

Teacher education programs across the country struggle with how to increase the technology integration skills of the students they educate. Not only are standards such as the National Educational Technology Standards for Teachers (NETS-T) (International Society for Technology in Education National Educational Technology Standards Project, 2000) being adopted, states are now requiring institutions to *guarantee* the technology proficiency of their graduates (University System of Georgia Board of Regents, 1998). At the rate of technological innovation, will it make any difference if pre-service teachers are taught simple productivity skills for both themselves and their students once the technology changes? What exactly should we be teaching pre-service educators about using technology in their future classrooms? The answer to these questions might help teacher educators to focus not only on what content and skills need to be taught, but also on what instructional strategies might be used in teaching about technology integration.

Factors Hindering Technology Use in the Classroom

Several factors have been cited as hindering new teacher use of technology. These include inadequate training in proper technology skills and methods, lack of technology modeling on the part of their university faculty, lack of positive technology experience in school settings, and university faculty out-of-touch with the technology explosion in schools and how it is effecting teaching practice (Kent & McNergnery, 1999; National Council for Accreditation of Teacher Education, 1997; Persichitte, Tharp, & Cafarella, 1997; Office of Technology Assessment, 1995; Byrum & Cashman, 1993). The re-design of entire teacher education programs is called for.

To this end, the Instructional Technology unit at Georgia State University determined to undertake a two-fold approach to increasing the technology integration skills of preservice teachers. First, in order to facilitate preservice training in proper technology skills, and methods, an on-line support system was developed not only for course use, but also to support the preservice teacher throughout student teaching and on throughout the critical induction experience. Secondly, to address teacher education faculty awareness and knowledge of teacher technology integration skills, and to increase modeling to technology integration skills throughout the preservice teacher experience, a portfolio development process was instituted with the Middle Childhood Education unit. Portfolios are assessed throughout the preservice program for meeting first technology standards, and then for meeting new teacher standards.

Early in 1999, Georgia Governor Roy Barnes formed an Education Reform Study Commission to look at ways to improve Georgia's schools. Governor Barnes used the results of the commission's study to produce the A Plus Education Reform Act of 2000 (2002). Out of the act came technology-related initiatives that impact teachers and teacher preparation programs. Primarily the act holds teacher preparation programs at universities and colleges responsible for their graduates' technology competencies. Universities and colleges

> shall require students in such programs to be proficient in computer and other instructional technology applications and skills including understanding desktop computers, their applications, integration with teaching and curriculum, and their utilization for individualized instruction and classroom management. There shall be a test to assess the proficiency of students enrolled in teacher preparation programs in computer and other instructional technology applications and skills. (p. 68)

Prior to the A Plus Education Reform Act of 2000 (2000), the Middle, Secondary and Instructional Technology Department (MSIT) recognized the need to prepare pre-service teachers in the area of technology integration. The Instructional Technology unit has been working closely with the Middle Childhood Education unit for the past four years to develop a WWW-supported resource based learning environment (RBLE)/methods course called *Teachers and Technology*, IT 3210. This course focuses on and models technology integration. It is a required course for Middle Childhood (MCE), Secondary Education (SEC) students and Foreign Language, Art, and Music (FLAM) students seeking teacher certification, and an elective course for Early Childhood Education students (ECE), as well as Kinesiology/Health (K/H) students seeking certification. The pre-service students generate a portfolio documenting the design of technology-supported instructional environment that facilitates student learning through the design and development of student-centered learning activities. The IT3210 portfolio serves as a starting point for middle grades students who continue with the portfolio assessment process throughout their studies at GSU demonstrating they have met INTASC (Interstate New Teacher Assessment and Support Consortium) Standards (Council of Chief State School Officers, 1999).

IT3210 and its web-based resources address the National Educational Technology Performance Profiles for Teachers as well as supports all six of the National Educational Technology Standards for Teachers (NETS-T) and contributes to student understanding of the INTASC Standards. The middle grades portfolio assessment addresses only the INTASC Standards.

Program Issues – Stand Alone Course or Cross Curriculum Integration?

Many teacher education programs focus on either a stand-alone course, or on a model of technology infused throughout all teacher preparation courses. Some schools, including GSU, have opted to do both. Kovalchick (1997) offers, "An approach that I have found useful is to blend elements from both a competency based models and integrative models into a reflexive approach in which students use technology as both learner and teacher. In this way, preservice teacher education students are challenged through direct experience to generate personally relevant conceptions of technology" (p. 31). Smaldino and Muffoletto (1997) also promote a combination approach. "Our model attempts to blend the contents of the existing single course with the need to nurture technology applications within methods and other courses. Thus, students first gain an understanding of the applications of technology in education in the broad sense, with an in-depth examination of how technology supports learning in specific content areas" (p.37).

Technology Integration Support for Preservice Teachers

Course Design History

Prior to 1997, the technology course at GSU was a stand-alone, skills-based course that focused on the use of technology as a teacher tool. Content included such technology usage as word processing, mail merging a letter home to parents, and using a spreadsheet program to calculate grades. Little to no learning theory or instructional methods were included in the lab-based course. In addition, the technologies covered were basic in nature – telecommunications coverage consisted of e-mail, and in later years, the Internet as a database of lesson plans. As pedagogy played virtually no role in the course, students were allowed to substitute a passing grade on a pencil and paper competency test.

In 1997, at the request of the Middle Childhood Committee, the standard skills-based preservice technology course underwent a major redesign. In the first year, the course refocused from teacher-resource-based, skills-based to a technology-integration-into-the-curriculum approach. This refocus was done in part to address a potential cause of low technology adoption in preservice teachers: deficiencies in technology-integration methods (Leggett & Persichitte, 1998).

In fall semester 1998, the IT unit worked with the MCC to redesign the course to further situate the course content in teaching methods. While maintaining a lecture/lab approach, a WWW-based, resource-based learning environment (RBLE) was introduced as part of the course (Hill, 1999; Shoffner, 1999). The course, and its related resource laden WWW site, incorporates a problem-centered, activity-based approach where the computer applications are anchored in authentic and familiar contexts in which teaching and learning occurs (Cognition and Technology Group at Vanderbilt, 1991; Vygotsky, 1978). This approach is based on the view of an open learning environment in which learners have direct input on the direction of the course based on their needs (Hannafin, 1999; Hannafin, Hall, Land, & Hill, 1994). In navigating through the environment and tackling challenges, it is proposed that students will also develop self-directed learning skills, which will serve them well as they enter the teaching profession. Along with confidence in using the technology, self-directed learning skills have been identified as a characteristic of successful technology-using teachers (Shoffner, 1996). The RBLE can be accessed at http://msit.gsu.edu/IT/3210/index.html . The site map for the course appears below in Figure 1.

At the same time, the course serves as an introductory teaching methods course, introducing preservice students to such concepts as instructional objectives, lesson planning, evaluation, and assessment. The course offers more than teaching the basic ADDIE instructional design model as a way to develop lesson plans while teaching about technology integration skills. In the *Technology for Teachers* course at GSU, the technology is immersed in learning about what being a teacher entails – briefly, planning, learning theory, instructional strategies, classroom management, and assessment. Our hope is that by introducing the technology and the methods together, early in the program, that a) students will forever forward view technology as natural to the learning process as the textbook and the pencil; and b) both the technology *and* the methods will be reinforced throughout their other courses at GSU. One way in which continuity and reinforcement occurs is in the use of portfolios for assessment. In the *Technology for Teachers* course, preservice students generate a portfolio documenting the design of technology-supported instructional environment that facilitates student learning through the design and development of student-centered learning activities. The use of portfolio development and assessment continues throughout the remainder of Middle Childhood Education program of study.

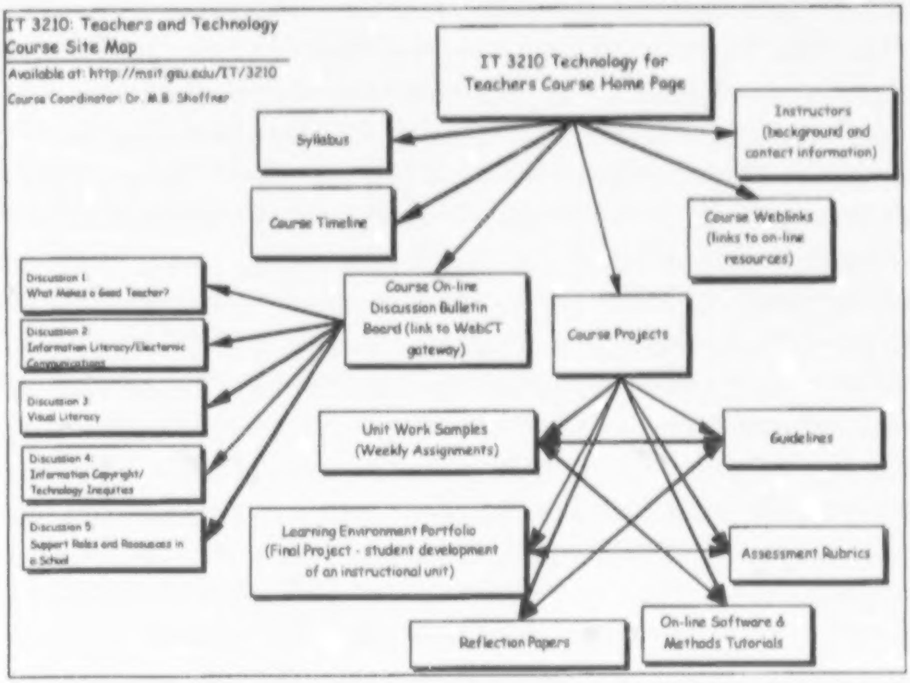
IT 3210: Teachers and Technology
Course Site Map
Available at: http://msit.gsu.edu/IT/3210
Course Coordinator: Dr. M.B. Shoffner
IT 3210 Technology for Teachers Course Home Page
Syllabus
Instructors (background and contact information)
Course Timeline
Course Weblinks (links to on-line resources)
Discussion 1: What Makes a Good Teacher?
Discussion 2: Information Literacy/Electronic Communications
Discussion 3: Visual Literacy
Discussion 4: Information Copyright/ Technology Inequities
Discussion 5: Support Roles and Resources in a School
Course On-line Discussion Bulletin Board (link to WebCT gateway)
Course Projects
Unit Work Samples (Weekly Assignments)
Guidelines
Learning Environment Portfolio (Final Project - student development of an instructional unit)
Assessment Rubrics
Reflection Papers
On-line Software & Methods Tutorials

Figure 1. Course Site Map of IT 3210: Teachers and Technology

From Course to On-Line Support System for NETS-T

One focus of this PT3 mini-grant was to expand the IT 3210 *Teachers and Technology* website to provide not only a backdrop for the course but also to serve as a resource for pre-service teachers during their student teaching experience as well as their first year induction period into the teaching profession. To facilitate this continued use, we redesigned the interface of the IT 3210 *Teachers and Technology* resource based learning environment (RBLE). Using the PT3 website development done by the project director in summer 2000, materials were merged into one master RBLE. The interface was changed from a homepage-linked pages interface (http://msit.gsu.edu/IT/3210/index.html) (Figure 2, below) to a frame-set interface (http://msit.gsu.edu/PT3/Shoffner/index.html) (Figure 3, below). The grant team felt this change was necessary to facilitate navigation through what is becoming a very large resource site. When complete, the site will serve not only the IT 3210 audience, but also as a mentoring resource to new teachers in the field. Furthermore, the new frameset navigation will allow users from other universities to more easily access portions of the site for their students (we continue to receive two to three requests for such use each semester). We had hoped the interface frameset would be in place for the entire site (with placeholder pages for approximately on half the content) by the mid March 2001. However, the development of the frameset interface required more time than initially anticipated. Now that the frameset interface is in place, work will resume this fall semester on the authoring and placement of content, as well as the identification of exemplar lesson plans for including in the site.

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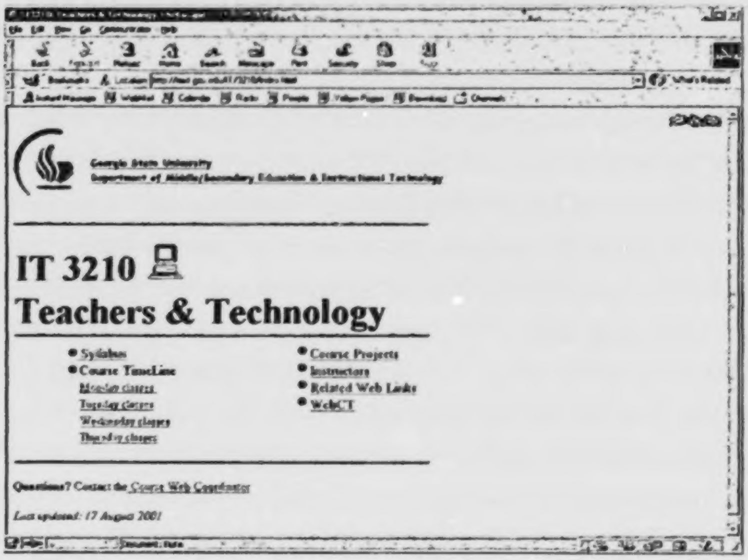


Georgia State University
Department of Middle/Secondary Education & Instructional Technology

IT 3210

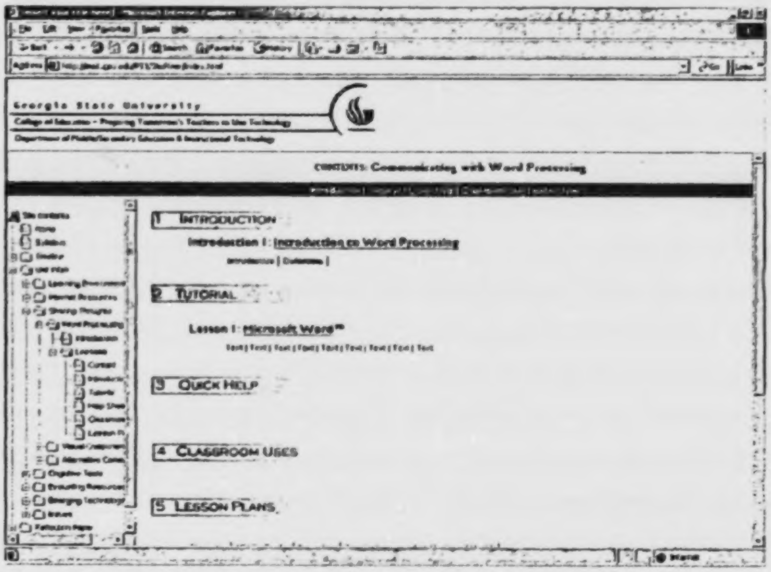
Teachers & Technology

- Syllabus
- Course TimeLine
  - Monday classes
  - Tuesday classes
  - Wednesday classes
  - Thursday classes
- Course Projects
- Instructors
- Related Web Links
- WebCT

Questions? Contact the Course Web Coordinator

Last updated: 17 August 2001

Figure 2. Screen Snap of Current Interface of IT 3210: Teachers and Technology



Georgia State University
College of Education - Preparing Tomorrow's Teachers to Use Technology
Department of Middle/Secondary Education & Instructional Technology

CONTENTS: Communicating with Word Processing

1 INTRODUCTION

Introduction I: Introduction to Word Processing

2 TUTORIAL

Lesson I: Microsoft Word™

3 QUICK HELP

4 CLASSROOM USES

5 LESSON PLANS

Figure 3. Screen Snap of Frameset Interface of IT 3210: Teachers and Technology Under Development

To assess continued use of the IT 3210 RBLE by preservice teachers throughout their program of study, we planned to mail a follow-up survey to fall 2000 IT 3210 students during the Spring 2001 semester. Informal interviews with fall 2000 IT 3210 students, however, indicated that the time elapsed between the close of the fall semester and the planned mid-March mailing was not sufficient. Students indicated they would be more likely to make use of the RBLE for final semester projects and for field experiences. Due to this feedback, the mailing was postponed to Fall 2001 semester. In spring 2002, fall 2000 IT 3210 cohort students will be surveyed to ascertain their continued use of the RBLE in their GSU coursework. This survey will seek responses to the following questions:

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- Do they access the site for support during their GSU class experiences?
- Do they access the site for field-based experiences?
- Do they feel prepared to use computers and the Internet for classroom instruction?
- What are their recommendations for the improvement of the support site?

Performance Profiles and Assessment Instruments

The second portion of the PT3 mini-grant project began more slowly. Assessment instruments were developed for two of the four NETS-T performance profiles: the general preparation performance profile and the professional preparation performance profile. Beginning Spring semester, 2001, all IT 3210 students completed a Likert-type self-report on the general preparation performance profile at the beginning of the semester. As IT 3210 is a part of the professional preparation of middle and secondary education programs, students should meet the general preparation performance profile prior to beginning the course. In the event that a student did not meet the general preparation performance profile at the beginning of professional studies, a second administration occurred upon completion of the IT 3210 course. In addition, all students complete a 24-item self-report on the professional preparation profile at the close of IT 3210. While self-report instruments lack rigor, students who successfully complete the IT 3210 course have been more rigorously assessed for not only the general performance profile, but also 20 of the 24 indicators on the professional preparation performance profile. In time, student self-report results will be correlated to class assignment grades. Sample items on the general preparation and professional preparation self-report instruments appear below in figures 4 and 5, respectively.

Technology Standards for Pre-Service Teachers – General Preparation

Please circle the number corresponding to how well each statement describes you *at this time*.
1 = not at all
2 = a little
3 = somewhat
4 = a lot
5 = very much so!

1. I am comfortable with the keyboard, the mouse, and the basic operation of the computer.	1	2	3	4	5
2. I use the computer for basic tasks on a regular basis.	1	2	3	4	5
3. I use technology tools specific for a given task (for example, graphing calculators, simulation software, and so on).	1	2	3	4	5
4. I use software tools to organize and manipulate data for clearer organization, problem solving, and decision-making.	1	2	3	4	5

Figure 4: Sample Items from the General Preparation Performance Profile Self-Report Instrument

To date, few assessment instruments for NETS-T developed by other PT3 initiatives have been identified. Conference presentations and discussions with colleagues inform us that a comparable assessment instrument for NETS-T is currently being validated at another university. As no other evaluation instruments were reported on, we anticipate using this validated rubric when it becomes available to in turn validate the GSU rubrics.

Technology Standards for Pre-Service Teachers – Professional Preparation

Please circle the number corresponding to how well each statement describes you *at this time.*

1 = not at all
2 = a little
3 = somewhat
4 = a lot
5 = very much so!

1. I can identify the benefits of technology to maximize student learning and facilitate higher order thinking skills.	1	2	3	4	5
2. I differentiate between appropriate and inappropriate uses of technology for teaching and learning while using electronic resources to design and implement learning activities.	1	2	3	4	5
3. I can identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction.	1	2	3	4	5
4. I can identify, select, and use hardware and software technology resources specially designed for use by PK-12 students to meet specific teaching and learning objectives.	1	2	3	4	5

Figure 5: Sample Items from the Professional Preparation Performance Profile Self-Report Instrument

Summary data collected using the NETS-T general preparation profile and profession preparation profile self-report instruments completed by Spring 20001 IT 3210 students is included in Table 1, below. At the beginning of the IT 3210 class, students showed an average composite score on the general preparation profile of 42 points of a possible 70 points. A score of 42 is the equivalent of students feeling they can "somewhat" meet all 14 indicators. In comparison, at the end of the class, average student composite scores on the general performance profile instrument for those same students increased to 54 points, indicating students felt more adept and comfortable with the technology. A larger net gain in average composite score would be expected; these are skills the student should have prior to entering their professional preparation. One possible explanation for this result is that students overrate their abilities at the beginning of a new course, particularly in the area of technology. Simply put, they don't know what it is they don't know. This theory is supported by the reduction of scores reported on the posttest by some students, indicating they didn't feel as confident in their skills and usage after completed the intensive course.

	General Preparation Performance Profile Self-Report *Pretest*	**General Preparation Performance Profile Self-Report** *Post test*	**Professional Preparation Performance Profile Self-Report** *Post Test Only*
Mean– Composite Score	42.1	54.0	91.2
St. Dev.– Composite Score	13.6	9.8	18.6
# items	14	14	29
Composite Score Possible Range	0 - 70	0 - 70	0 - 145
Composite Score Actual Range	18 - 67	33 - 70	39 – 120

Table 1: NETS-T Self-Report Instrument Summary Data – Matched-Pre-Test Post test Data Only

MCE Portfolio Review

The Middle Childhood Education Unit and the Instructional Technology Unit together formed a program oversight committee, the Middle Childhood Committee (MCC). At GSU, The MCC established a continuous process of portfolio development and assessment for all students (Shoffner, Dias, & Thomas, 2001Shoffner, Thomas, & Dias, 2001). This was a key process for integrating technology across the program and into the content of every course. In response to the Board of Regents guarantee principle, increasing accountability in teacher preparation programs, and the Middle Childhood Committee's recommendation to strengthen the preservice teachers' overall professional development, the committee recommended that the program include an exit assessment that examined the student's ability to apply what they learned in all their courses in some cohesive manner. After examining several assessment models, both traditional and alternative, a portfolio development process with benchmarks throughout the program and final submission as an exit requirement was adopted.

Although most skills and concepts are developed in individual courses, it is important that preservice teachers have command of these concepts and skills with knowledge of how to integrate these concepts and skills into all aspects of teaching. Therefore, a major goal of portfolio requirement was to develop the preservice students' ability to integrate several components of the program across all courses and to develop knowledge and skills in applying these components in all aspects of teaching. Among key skills and concepts under discussion were: integrating technology into learning, developing and implementing lesson plans and assessment strategies, developing and implementing a classroom management plan, working with diverse learners, developing as reflective practitioners, and so on. After a review of the principles of the Interstate New Teacher Assessment and Support Consortium (INTASC), the committee agreed that the principles of INTASC encompassed and addressed all major components of the middle childhood program and could be used to facilitate the development of the preservice teachers. Thus the committee established portfolio guidelines that focused on the ten principles of INTASC.

Through the continuous collaboration of the MCC, guidelines for portfolio development were documented, benchmarks were established, implementation procedures were outlined, and an assessment instrument and procedures were designed. The committee reviewed course syllabi for all MCE undergraduate education courses to determine which INTASC principles were met in each course. The principles were aligned with the program's schedule of course sequence and experiences to establish which principles the preservice students would be able to address at established intervals. These intervals serve as benchmarks to assess the students' portfolios. Portfolio development is introduced in the Teachers and Technology course in the form of the learning environment portfolio. Subsequent submissions are based on the INTASC principles, and occur at the end of the first year of professional studies, prior to student teaching, and at the close of student teaching.

Another aspect of our PT3 mini-grant study was to determine if subsequent MCE student portfolios could be examined to determine preservice students' ability to meet NETS-T standards as they continue through their professional preparation program. A rubric was developed for the 24 indicators of the professional preparation performance profile and applied to Middle Childhood Education student portfolios submitted prior to entrance to the professional sequence of coursework. *(Note: the rubric is too long and detailed to be included within this paper, but can be obtained from the authors upon request.)* The objective of these portfolios was for students to demonstrate six of ten INTASC principles. We were hopeful that data analysis would indicate that students continue to apply the technology integration skills mastered in IT 3210 to other courses in their program of study.

However, that was not the case. Review of six MCE INTASC portfolios submitted in May 2001 showed little student documentation of technology competencies. It was surmised that as students were not specifically directed to demonstrate technology competencies, they simply did not do so. A second factor that might have contributed to the lack of technology demonstrated in these portfolios was timing. Several MCE students were compiling their IT 3210 portfolios at the same time as they were compiling the IT 3210 portfolios. It is conceivable that technology artifacts went in one portfolio, and not the other.

Consultation with MCE faculty indicated that asking MCE students to specifically include technology in their INTASC might dilute the attention they paid to addressing the INTASC principles. Furthermore, it was decided that review of all MCE courses should be conducted to determine when and where students were addressing technology integration skills.

MCE Program Review

In order to determine what NETS-T performance indicators were addressed and reinforced in each of the courses that make up the MCE program, a matrix was developed for MCE faculty in May 2001. The matrix, included in appendix I, maps the NETS-T performance indicators for the general preparation profile, the professional preparation profile, and the student teaching/internship profile against all courses in the MCE program. Faculty were asked mark what performance indicators were addressed in their courses (regardless of indicator level) prior to the October 2001 meeting. To date, data from seven courses in four content areas have been received. The data from the remaining nineteen courses are expected when the MCE faculty meets in early October. Once all courses have been reviewed, decisions will be made to ensure students meet all NETS-T performance indicators in their coursework at GSU. In addition, once coverage of all NETS-T standards has been assured, the MCE INTASC portfolio will be accepted in electronic format only.

Conclusions

Accountability directives for new teacher preparedness are not likely to go away any time soon. Indeed, in his first month in office, United States President Bush proposed education initiatives to increase teacher accountability similar to those in place in the state of Georgia be implemented nationwide. Instructional technology preparation will likely continue to be a critical issue in teacher education for many years to come. Instructional technology units can no longer teach only to their corporate training design and development roots. For colleges of education to successfully prepare teachers for the 21st century, instructional technology will need to be more cohesively included in teacher preparation programs. It is imperative that more cooperative partnerships be established between instructional technology units and initial preparation programs. The authors encourage IT units to initiate and nurture these partnerships, making possible more innovative approaches to this important field of study. While many PT3 initiatives are on too large of a scale to be adopted without a large commitment from teacher education programs, the strategies presented in this paper may be attempted at any institution with little risk.

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Facilitating Technology Integration Through Effective Professional Development: A Local School Model

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Abstract

The purpose of this study was to develop a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. The local school technology committee conducted an informal performance analysis to determine a plan of action. As a needs assessment, stakeholders were surveyed to determine requisite technology professional development for the local school staff. From this data, a long-range professional development plan was created, including goals and objectives for each year, an in-depth yearly plan with detailed implementation procedures for each objective, and individual teacher plans. The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. A comparison of pre- and post-assessments indicated that participants increased technology skills by 29.59%. During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level; all participants scored in the intermediate or advanced category.

As we move forward in the twenty-first century, our world is undergoing a technological revolution much like the industrial revolution of the nineteenth century. Technology is permeating and transforming every part of our society. In the face of these rapid changes in business and at home, technology literacy is more important than ever. In order for our graduates to be prepared to meet the challenges of the business world in the twenty-first century, they must be proficient at accessing, evaluating, and communicating information. As businesses learn to compete in a global environment, students must also become globally aware and able to use technology resources that exist beyond the walls of the classroom. Students preparing for this global workplace must be able to use technology or "face a lifetime of menial work" (U. S. Department of Labor, 1991, p. 15).

The National Center for Educational Statistics (2000) reported that the average number of computers in classrooms in the United States has grown significantly in the last twenty years. This number has grown from one computer for every 125 students in 1983 to one computer for every six students in 1998. In addition, Internet availability in public schools has increased from 35 to 95 percent between 1994 and 1998. Unfortunately, availability has not ensured use.

Policymakers and the public are beginning to question the effectiveness of these substantial investments in equipment and infrastructure and demand evidence that they have been worthwhile (Trotter, 1998). Some suggest that if all the computers were taken from schools tomorrow, it would not make a difference. In contrast, businesses in this country would be immobilized without technology (Peck & Dorricott, 1994). Why is it that "businesses have been building electronic highways while education has been creating an electronic dirt road?" (D'Ignazio, 1993, p.11).

Substantial investments in technology hardware, software, and infrastructure will not impact teaching and learning until teachers have the technology skills and technology integration strategies needed for today's modern classrooms. McKenzie (1999) suggests, "The best way to encourage teachers to embrace these technologies is to give them personal learning experiences which win them over to the worthwhile classroom activities which are now possible" (p.6). Local schools and districts must concentrate on professional development to reap a significant return on these investments (Rettig-Seitam, 2000).

Purpose of the Study

The purpose of this study was to develop and implement a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. Although states such as Georgia (State Data and Research Center of the Georgia Institute of Technology, 2001), Florida (Swain, 2000), Michigan (Hoffman & Thompson, 2000) and North Carolina (Walbert, 2000) have begun to fill the gap in providing much needed training for teachers, effective local school models are still needed. Many teachers have received little or no technology integration training, because the diffusion process is very slow. Well-designed local school plans can augment state initiatives and provide the professional development teachers need to successfully integrate technology into instruction.

Staff development models that focus on school improvement initiatives are often initiated to address a problem. The successful completion of the initiative may call for teachers to gain specific knowledge or skills. This information may be obtained through reading, discussion, observation, training, or trial and error. In other cases, experiential learning may occur in the development and improvement process. The model developed and implemented in this study is a combination of the knowledge that results from teacher involvement in a development and improvement process (Sparks & Loucks-Horsley, 1989).

The development and implementation of the model was a multi-step process. The first step was to identify the theoretical underpinnings that formed the background for the study and to detail the assumptions on which the model was based. The development of the model and assessment plan included an informal performance analysis, development of needs assessment instruments for all stakeholders, creation of the implementation plan, and development of the pre- and post-assessments.

Assumptions of the model

The first assumption on which this model is based is that adults learn most effectively when they have a need to know or solve a real-life problem (Knowles, 1980). Knowles' theory of adult learning has become well known in recent years and proposes the following assumptions of adult learning:

1. Adults have a need to be self-directing.
2. Adults bring a wealth of experience that should be used in a learning situation.
3. Adults' readiness to learn is based on a need to solve a problem.
4. Adults want to make immediate application of knowledge.

Teachers serving on a school improvement team may need to review research on effective teaching, learn new group and interpersonal skills, or acquire content knowledge for new curriculum initiatives. In each of the above examples, teachers' learning is motivated by the need to solve a problem.

Secondly, this model assumes that those working closest to the problem best understand what is needed to improve their performance. Teachers rely on their teaching experiences to guide them as they identify problems and develop solutions. Given the opportunity, the unique perspective of teachers can add to the school improvement process (Sparks & Loucks-Horsley, 1989).

Finally, this model assumes that teachers obtain important knowledge through their participation in the school improvement process. Teachers' involvement in the process may foster alteration in attitudes or the development of problem-solving skills as individuals or groups work toward the solution of a problem. For example, teachers may begin to appreciate individual differences, improve group leadership skills, or just become more aware of the perspective of other staff members. Although this type of learning may be difficult to predict, it is significant to the teachers (Sparks & Loucks-Horsley, 1989)

Description of the Population

The population involved in this study was the staff of an elementary school in a metropolitan area of a large city in the southeastern United States. The staff had 69 certified teachers, 17 teacher assistants, 2 school counselors, 2 speech and language pathologists, 1 technology support technician, 5 clerical staff, 1 clinic worker, 8 cafeteria staff, 4 custodians and 3 administrators. Among all certified teachers, 32 held a Masters degree or higher, 6 had gifted certification, 3 had ESOL certification and 7 had special education certification. New teachers to the school were provided with a mentor who was available for planning and helping with basic information and procedures. The professional learning community worked together in a collaborative manner to promote teaching and learning and achieve annual school goals.

The school was organized using a leadership model known as Shared Governance. Each grade level, including teacher assistants and clerical personnel, had a chairperson who met with the administrators every month to coordinate and discuss curriculum matters, school organization, areas of concern and monitor the Local School Plan for Improvement (LSPI). Dialogue flowed to and from the individual grade level groups through the communication vehicle of the Shared Leadership Team (SLT). SLT made decisions after careful consideration of colleague feedback and available data.

The school had been honored as a School of Excellence and was committed to the continuous improvement process. The Local School Plan for Improvement (LSPI) was written each year using pertinent data and input from the staff. LSPI goals identified specific improvement efforts. Each staff member set individual goals based on the local school LSPI goals. When staff members successfully completed their individual goals the payoff was seen in improved school-wide LSPI results. Certainly, one of the major benefits of the LSPI was the opportunity for staff development in the identified areas of improvement. Teachers had the opportunity to improve teaching strategies and learn cutting edge research at the local school.

Development of the Professional Development Model And Assessment Plan

With the 1998 completion of the school network, every classroom received a multimedia computer with Internet, email, and a laser printer, and the school had three computer labs with Internet connections. As technology resources increased, teachers requested more on-site technology professional development. To meet the growing demands, the technology coordinator worked the technology committee to develop a comprehensive plan for technology professional development. The development of this plan was based on the principles of instructional system design described by Reigeluth, Benathy, and Olsen (1993) and Mager and Pipe (1997), which included a performance analysis, a needs assessment, the development and implementation of a professional development plan and the assessment of the impact of the professional development plan.

Performance Analysis

Although the school had received a large infusion of technology in the last several years, classroom computers were not being fully utilized and computer labs were mainly being used for drill and practice activities. The school leadership team and technology committee recognized this problem and began to investigate solutions that would foster technology integration into the curriculum. This was important because the district had invested about a million dollars in technology hardware, software, and infrastructure in each elementary school in the district. With the district's focus on accountability for results and continuous improvement, the local schools were being asked to measure the impact of technology on teaching and learning. The technology committee and school leadership team realized that the majority of the teachers did not feel they were adequately prepared to use the new technology tools in instruction.

Needs Assessment

With the completion of the preliminary performance analysis, the technology committee developed several surveys to ensure that the interests, values, and perspectives of all stakeholders would be represented in any instructional design or organizational change. The stakeholders- -all the groups who had a stake in the instructional system being designed- - in this project included teachers, assistant teachers, students, and parents (Reigeluth, 1996). The survey of veteran teachers included questions on staff development preferences such as class organization, session length, optimal time of day for instruction, teacher interests and needs, and obstacles to success. The new teacher survey was designed to identify baseline skills for new staff members. The purpose was to identify any significant training gaps between existing staff and new staff. The survey of the assistant teachers sought to identify essentials skills that support staff needed to effectively aid teachers with instruction. Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the instructional technology competencies developed by the local school district. The parent survey was designed to gain the parents' perspectives and knowledge of local school technology initiatives.

Intervention Selection and Development

Prior to the development of the implementation plan, a careful analysis of data from all the stakeholders' surveys was completed to determine needs and interests of the local school staff. The first step in the process was the development of a long-range plan. This overview included the goal for the professional development plan and objectives for each year. Second, an in-depth yearly plan was developed with detailed implementation procedures for each objective. Each objective listed baseline data, indicators of success, measurement tools, an implementation plan of activities, responsible parties, and completion dates. Next, an individual teacher professional development plan was created. This plan was directly correlated to the yearly implementation plan. The individual teacher plan also included a professional development log and a rubric for administrators to use in evaluating individual teacher professional development plans. Based on data from all the stakeholder surveys, a menu of technology professional development classes was developed to support the implementation plan. Due to the wide range in teacher knowledge and skills, provisions were also made for an independent study option.

Implementation of Professional Development Plan

In the early fall, the technology committee completed surveys of all stakeholders. The data was compiled and analyzed for strengths and weaknesses. The results were used to plan technology professional development for the school year. A menu of 29 classes was created by the end of September. Based on the yearly professional development plan, each teacher developed a personal plan for improvement. In January, the administrator on the technology committee and the technology specialist met with each grade level to informally discuss the progress made on the school goals. In addition, each certified staff member met with the t echnology administrator in January and February for an interim review of progress on individual teacher goals.

Implementation Assessment

A pretest-posttest design was used to assess the implementation plan. Pretests were administered in August 1999 and posttests were completed in April 2000. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Data analysis involved the comparison of pretest and posttest data for each objective of the yearly implementation plan. Analysis of the data was completed for each grade level and for the entire staff. The analysis gave a percentile score and a beginner, intermediate, or advanced skill level for each teacher and an average for the entire staff.

Summary

The development of this plan took several months and implementation spanned an entire school year. Throughout the process, the staff at the local school was given opportunities to evaluate the progress toward the professional development goals. This type of feedback spiral was designed to foster continuous improvement through individual growth, as well as growth of the local school organization (Costa & Kallick, 1995).

Methods

In order to develop the plan and to assess its effectiveness, data was collected at three stages, performance analysis, needs assessment, and assessment of the professional development plan. Data collected at each of the first two stages informed the development of the next stage.

Performance Analysis

The technology committee conducted an informal performance analysis. The committee was composed of an assistant principal, the technology specialist, the media specialist, and one representative from each grade level. The data examined during this process included the amount of money spent on technology resources in the past few years, the usage of classroom computers and labs, and teacher preparedness to use technology tools to enhance instruction.

Needs Assessment

Prior to the development and implementation of the professional development model, survey data was collected from all stakeholders to ensure that the interests and needs of each group would be addressed by the plan. Veteran teachers, new teachers, and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five veteran teachers, twelve new teachers, and twelve teacher assistants at the local school participated in the needs assessment. In addition, parents and students were surveyed. All surveys were in paper and pencil format and were distributed and collected by members of the technology committee.

Assessment of the Implementation Plan

A self-assessment instrument was developed to gage teacher progress in acquiring technology integration skills. The paper and pencil assessment contained twenty questions to monitor teacher progress. For each question, teachers were to mark their proficiency level from one to five, with level one indicating a minimum skill level and level five indicating a maximum skill level.

Results

Veteran teachers, new teachers, and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five surveys (100%) were received from veteran teachers, 12 surveys (100%) were received from new teachers, and 12 surveys (100%) were received from teacher assistants at the local school. In addition, 303 parents and students were surveyed. The fourth and fifth grade students returned 266 surveys (88%). Parents returned 99 surveys (33%). Due to the low return rate, parent data was not used in the project development.

Teacher Surveys

Veteran teachers were asked to respond to six questions concerning technology professional development needs, interests, and preferences. Table 1 shows the survey results. Percentages were rounded to the nearest whole number.

An analysis of survey data indicated the following staff development preferences: small group classes (72%) and class sessions of 30 minutes to 2 hours (96%). Major areas of interest for technology use included technology to assist in the organization and access of student information (34%), technology used as an integral part of lesson plans (35%), and technology to improve students' writing skills (31%). Teachers indicated that the biggest obstacle to technology integration was lack of time to plan technology -connected units (75%).

Table 1. Teacher Professional Development Preferences
N=65

Teacher Professional Development Preferences	Frequency	Percentage
Technology staff development can best meet my needs when it is		
Taught in small grade level groups	47	72
Taught one on one	6	9
Taught in a large group lab setting	12	18
Technology staff development can best meet my needs when taught in		
Mini class sessions (30 minutes)	30	46
In-depth sessions (1 - 2 hours)	31	48
Very in -depth sessions (1/2 day or 1 day)	4	6
Technology staff development can best meet my needs when offered		
During the contract day - before school	29	45
During the contract day - after school	6	9
During the contract day - during a planning period	6	9
As an SDU class before school - not on contract time	13	20
As an SDU class after school - not on contract time	19	29
Technology staff development can best meet my needs when classes are		
Organized by beginning, intermediate or advanced skill levels	31	48
Organized by topics of interest with mixed technology skill levels	22	34
Are organized according to grade level needs and interests	14	22
I am most interested in learning to use technology		
That can average my grades and print reports for parents	14	22
That will help me to organize and access student information	22	34
To improve communication with parents and students	14	22
As an integral part of my regular lesson plans	23	35

To assist my students in learning the research process	15	23
To assist my students in improving keyboarding skills	8	12
To assist my students in improving writing skills	20	31
The biggest obstacle I face in integrating technology into the curriculum is		
Lack of time to plan technology-connected lesson/units	49	75
Insufficient access to computer hardware/equipment	8	12
Insufficient access to instructional software	10	15
Insufficient training in the use of the technology tools	12	18
Not comfortable using technology with students	1	2

New Teacher Survey

The survey of new teachers included first year teachers and teachers who were new to the local school involved in this project. The survey was designed to identify gaps in teacher technology skills. Table 2 indicates new teacher survey results. Percentages were rounded to the nearest whole number.

Analysis of the results indicated staff development needs in several areas. In basic network navigation, only 25% of teacher could log on or off the network and 17% could save file to the school server. Second, 17% of the teachers reported that they could detach e-mail attachments or create e-mail groups. Other needs identified included using satellite or distance learning resources, using Accelerated Reader to support reading, creating a basic web page, and basic computer troubleshooting skills.

Table 2. New Teacher Technology Professional Development Needs
N=12

New Teacher Technology Skills	Frequency	Percentage
Knows correct way to start up and shut down a computer with Windows 95	12	100
Knows how to log on and log off of Novell Netware	3	25
Knows Windows 95 basics such as minimize, maximize, open, close, & quit	12	100
Knows how to use Windows 95 Explorer to organize personal computer files	2	17
Knows how to save files to the courseware server	2	17
Knows how to back up network files to floppy disk	4	33
Knows word processing basics such as changing fonts, size, and style	10	83
Can save and print word processing files	11	92
Can copy and paste graphics and text in word processing	5	42
Can create tables in word processing	1	8
Can create newsletters in word processing	6	50
Can reply and forward email	10	83
Can send email attachments	4	33
Can detach email attachments and save to the courseware server	2	17
Can create email groups	2	17
Can type in an internet web address and bookmark a web site	7	58
Knows how to use an internet search engine such a Yahoo	8	67
Knows how to make a basic web page	2	17
Knows how to plan and manage taking a class to computer lab	8	67
Can create and teach a technology-connected lesson plan	6	50
Knows how to us satellite resources such as the Peach Star Pipeline to support instruction	2	17
Knows how to use the Accelerated Reader program to support reading instruction	2	17
Knows how to use computer tutorials or the help menu in computer programs	2	17
Can troubleshoot a frozen computer or a jammed printer	2	17

Teacher Assistant Survey Results

The teacher assistant survey was designed to identify gaps in skills needed to support instruction. Table 3 shows data from teacher assistant surveys. Percentages were rounded to the nearest whole number. An analysis of survey data indicated greatest needs for additional training in the areas of e-mail attachments, using the computer for student drill and practice, and basic computer troubleshooting.

Table 3. Teacher Assistant Survey Results

N=12

Technology Skills	Can do task independently Percentage	Can do task with assistance Percentage	Cannot do this task Percentage
I can start up, log on, log off and shut down an IBM computer.	100	0	0
I know how to search for a book or video on the media center online card catalog.	100	0	0
I can save to the server and print in word processing	43	17	25
I can access my e-mail account	75	0	25
I can reply and forward e-mail	58	17	25
I can troubleshoot a frozen computer.	17	17	50
I can use the classroom computer for student drill & practice, and/or educational games.	8	8	50
I know Windows 95 basics such as minimize, maximize, close and quit	100	0	0
I know word processing basics such as changing fonts, size and style.	42	25	25
I can send e-mail attachments.	8	25	50

Student Technology Survey Results

Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the elementary instructional technology competencies developed by the local school district. Table 4 shows data from the student surveys.

Table 4. Student Technology Survey Results

N = 266

Technology Skills	Can do task independently Frequency	Can do task with assistance Frequency	Cannot do this task Frequency
I can use the correct finder positions for keyboarding.	137	48	81
I can edit my own writing using spell checker.	153	53	26
I can change fonts and sizes in word processing.	189	27	11
I can save my work.	191	23	9
I can print my work.	182	28	10
I know how to go to or look up web sites on the internet.	129	60	35
I know how to search for information on the internet or CD ROM to complete classroom assignments.	110	77	40
I know how to start, minimize, close, quit and shut down the computer.	158	49	15
I know how to properly load and eject a CD ROM from a computer.	190	26	9
I know how to make a Kid Pix slide show.	94	88	42

Assessment of Implementation Plan

A pretest-posttest design was used to assess the effect the yearly implementation plan. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Analysis of the data was completed for each grade level and for the entire staff. The analysis provided a percentage, a skill level for each teacher, and a mean score for the entire staff.

A pretest and posttest was administered to all certified teachers. Scores were reported in percentages. A score between 0 and 39% indicated a beginner skill level, a score between 40 and 79% indicated an intermediate skill level, and a score between 80 and 100% indicated an advanced skill level. Table 5 shows the summary data for the implementation plan.

Table 5. *Pretest and posttest summary data*

	N	*M*	*SD*	*SE*
Pre	61	43.1	14.7	1.9
Post	61	72.7	13.9	1.8

Tables 6 and 7 compare pretest and posttest skill levels by grade level. On the pretest, only two grade levels had any advanced scores. In comparison, the posttest scores revealed that all grade levels had gained in the advanced skill level except for fourth grade. In addition, all pretest beginners had progressed to intermediate or advanced skill levels.

Table 6. Pretest Staff Skill Levels By Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	6	1	0
1st Grade	4	4	0
2nd Grade	3	5	0
3rd Grade	3	4	1
4th Grade	4	3	0
5th Grade	5	2	0
Teacher Specialists	2	5	0
Special Education	5	5	1
Totals	**32**	**29**	**2**

Table 7. Posttest Staff Skill Levels by Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	0	6	1
1st Grade	0	6	2
2nd Grade	0	3	5
3rd Grade	0	7	1
4th Grade	0	7	0
5th Grade	0	3	4
Teacher Specialists	0	2	5
Special Education	0	5	6
Totals	**0**	**39**	**24**

Discussion

This project attempted to develop and implement a model of local school professional development that facilitated technology integration into the curriculum. Prior to the development of the model, surveys were administered to the stakeholders. The data was compiled and analyzed to identify the needs and concerns that should be addressed by any new professional development initiative.

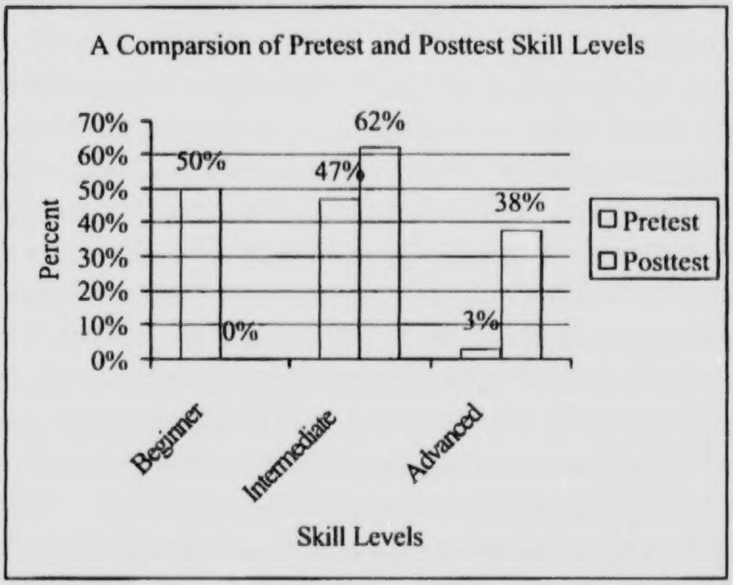
Through the development and implementation of the model, the participants at the local school recognized that all parties were change agents in the technology integration process. Successful integration of technology in the curriculum required the collaboration, shared responsibilities, cooperation, and investments of time and effort from all involved stakeholders.

To facilitate the integration of technology into the curriculum, all staff members at the local school were involved comprehensive on-site technology staff development. Professional development was designed to support the local school improvement plan and district continuous improvement initiatives. Staff members responded positively to the convenience of on-site training, but sometimes training was hampered by local school distractions. The inclusion of an independent study option provided increased flexibility for staff members to pursue some of their own interests for professional growth.

Conclusions

The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. The mean difference between the pretest and posttest scores was 29.59, which was statistically significant, t_{05}=20.506. In addition, all participants made significant advances in skill level (see Figure 1). During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level. All participants scored in the intermediate or advanced category.

Figure 1. *A Comparison of Pretest and Posttest Skill Levels*



The main beneficiaries of the extensive focus of technology training were the students. As a result of improved teacher technology skills, students had the opportunity to use technology create multimedia slide shows and web pages, produce live action videos, and use internet and CD ROM resources for research. In addition, several students won county and state media festival awards for multimedia and video projects that were related to the curriculum.

Recommendations

After examining the data from the professional development initiative and reviewing research on effective professional development, the following improvements to the model are recommended for future years of implementation:

1. Offer an on-site menu that includes more choices and less mandated sessions for staff members.
2. Offer options for large group training, small group classes, and one-on-one mentoring to better meet the various learning styles of the staff.
3. Improve and increase follow-up training to ensure successful implementation of the professional development initiative.

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VIRTUAL QUESTS AS LEARNING ENVIRONMENTS FOR K-12 STUDENTS

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Abstract

Virtual quests, such as the MayaQuest expedition produced by Classroom Connect, are excellent examples of classroom experiences that provide students with authentic opportunities to solve real life problems. This applied qualitative study looked at the value of virtual quests as classroom learning environments, at the instructional characteristics of teachers who chose to participate, reviewed related literature, and discussed, from the teacher's perspective, their application in a classroom setting.

Introduction

Use of the Internet in today's classrooms can offer opportunities that enrich and expand existing curriculum, support educational standards, and rejuvenate the teaching and learning process. Access to original documents, photos, video, sound, content experts, and live data, expands the resources available to the learner in a way that can make learning more engaging, interactive and authentic.

Perhaps some of the most engaging, comprehensive and unique, web-based activities are virtual quests that take student participants along on real expeditions, following a team in the field as they explore new territory or do research on authentic scientific problems. This study looked closely at these comprehensive virtual quests, defined their common characteristics, reviewed related literature on their efficacy in the K-12 setting, and discussed, from the teacher's perspective, their application in a classroom setting.

Virtual Quests

Although the term virtual field trip is often used in reference to these large quests, it can be misleading, as the term "virtual field trip" also refers to any number of non-interactive sites that can be found on-line. In contrast, virtual quests have the following unique characteristics:

- **Problem-based**: Focus is on an authentic mystery to be solved,
- **Curricular focus**: National standards support the content,
- **Multidisciplinary**: Resources and activities reach across the disciplines.
- **Real time interactivity**: A team in the field interacts with participants via e-mail, live chats, and video.
- **Participants as stake-holders**: Students are asked to make decisions about the quest that the field team acts on, i.e. should the team give money to beggars, travel through the jungle or into the cave?
- **Website as communication central**: The site contains activities and resources for teachers and students. It is highly visual and interactive, and is the center for daily updates and shared knowledge creation.
- **Scheduled**: The real-time component usually last six to eight weeks, although some last as long as a year.

Classroom Connect sponsors two expeditions a year that follow a team of explorers and scientists on a quest to solve a great mystery. The live experience of the Classroom Connect quests last for four weeks, although the website becomes live one week before the field team starts posting. The broad range of resources available on the site makes it possible for teachers to choose areas of focus most pertinent to their curricular needs.

Comprehensive virtual quests are designed to engage students in learning that includes authentic problem solving, real-time interaction with experts on the field, and an opportunity to share their research data, writing and artwork with an international team of peers. Over the past years I have offered teachers the opportunity to participate in virtual quests with their students, but had received a limited response. Even those who did commit did not take full advantage of the quest activities by following the quest consistently and engaging students.

The purpose of this study was to review associated literature that might support, or not, the validity of virtual quests in classroom, to identify the aspects of student outcome that would justify their use and to better understand the issues of quest implementation in the classroom, so that I might be able support teacher adoption in the future.

Literature Review

Research on the effectiveness of virtual quests is lacking. However, it is possible to examine research on the Internet in the classroom, writing, problem based learning, situated cognition, and anchored instruction.

Michael Ritter, a professor of geography, did a descriptive case study on virtual field trips with his students who visited key locations on-line by following a path of hyperlinked pages, gathered and analyzed data from photos and text, and kept field journals (1998). Ritter stated that the value of virtual field trips for learning geography is that it brings remote, dangerous or expensive locations into the classroom.

Lee and Songer looked at the effect of on-line collaboration on students' discourse about weather science, through the One Sky project (1999). They found that this collaborative on-line experience connected student personal experience with scientific learning. It made science learning more authentic. Students became local experts and knowledge producers and developed a higher level of language applied to science.

Jean Lave, the key proponent of situated cognition, recognizes that learning occurs as a function of activity and that it is situated in the context of the learning environment (1988). The model of situated cognition involves a multidisciplinary, collaborative approach to complex problem solving with embedded data. Brown, Collins and Duguid point out that traditional learning is often disconnected from the context of content (1989). For example, students learn the vocabulary of science by using the dictionary, writing sentences or reading textbooks. This approach is devoid of any structure or clues that might help the student make connections to real meaning. In a situated learning environment, students might be asked to work like scientists, experimenting, observing, hypothesizing and recording. Situated cognition has learning occur within a community or culture of practitioners. Brown, Collins and Duguid note that activity, concept, and the culture of the learning community are interdependent (1989). Students who work and study like scientists are more likely to have a structure on which to build knew scientific knowledge.

Anchored instruction, a concept developed by the John Bransford at the *Cognition and Technology Group at Vanderbilt (CTGV)*, situates authentic problems into what are called macrocontexts, or story-like situations (1993). The problems are anchored around these realistic situations that may involve an adventure. The students can solve the challenge by using information embedded in the story. The story, or anchor, engages the student in realistic and relevant problem solving. Research done by the CTGV found that students:

- performed as well as or better on standardized tests than the control group.
- demonstrated superior performance on multi-step word problems.
- showed less anxiety about mathematics.
- were more likely to see mathematics as relevant to their lives (CTGV, 1993).

In summary, the theory of situated cognition proposes that students are more likely to develop skills that will transfer to new learning situations, if they are engaged in authentic activities that focus on development of problem solving skills. Anchored instruction has applied the theory of situated cognition to the classroom setting and promotes the development of activities that create situated environments.

Virtual quests such as those produced by Classroom Connect and The JASON Project, are anchored learning environments. Students are asked to help scientists in the field find solutions to real world problems. They place students into a community of learners where they can share their observations, responses, data and questions with an authentic audience. They can focus on solving complex problems with the support of the virtual community. Learning content such as math, biology, geography, or culture may even be, in many cases, unintentional or incidental.

The quests produced by Classroom Connect, are examples of comprehensive virtual quests. Its Adventure Learning Division produces the expeditions, and adventure is key to their quest experiences. Their team of explorers travels exotic places on bicycle, a mode of transportation to which students can easily relate. America Quest has taken students to the Four Corners region of the United States, Australia, Central America, Asia, Africa and Galapagos Islands.

Each of their quests must be organized around a real mystery, or what CTGV (1990) would refer to as an anchor or macrocontext. The mystery of the Spring 2000 America Quest expedition focused on the sudden disappearance of the Anasazi people from their homes over 700 years ago. Experts in the field don't have a clear understanding of what happened to the Anasazi. No one knows the answers at the outset, students, teachers or field experts, and it is unlikely that they'll know the answers when the expedition ends. The problem of the disappearance of the Anasazi is a very complex one. Clues are available but they conflict. Some experts say that the Anasazi were violent people; perhaps they were running from their enemies. Others say the opposite is true; they were peaceful and were affected by environmental changes. As participants in America Quest, students are exposed to the complexity of real world problems and the reality that solutions come from considering many perspectives.

Student participants are addressed to directly by the America Quest expedition team. Daily journal postings are written with them in mind, including descriptive language, interesting topics, and lots of multimedia. Students are considered to be members of the team, and are solicited for their input in a number of ways. Many of the postings from the expedition team include polls. Students can email the team, the on-line experts and each other. Responses are posted to the site bulletin board where students are also invited to post. The audience of archaeologists, anthropologists, environmentalists and biologists value their responses acting as mentors to the students' developing knowledge. Immersed in the culture of exploration, students are witnessing the language and behavior of experts in the field. They are called upon by the team to share their input and are being acknowledged for their thought processes.

In order to make informed statements and decisions, students need to do some study and research. America Quest also provided a large amount of archived topical information on its site. Students are encouraged to use whatever online or offline resources are available to them, in the same manner that their teammates in the field do. Immersed in the culture of archaeology and anthropology, students were building knowledge about Anasazi culture, environment and their modern day successors. They are acquiring knowledge as a tool rather than a collection of facts.

Although most classroom participants are not prepared to tackle an investigation of this scale, the contributions they do make are clearly part of the process. There are also several smaller problems that students are called upon to solve. On the America Quest expedition, Dan Buettner presented the students with a weekly ethical dilemma called Dan's Dilemma, for example whether or not to photograph the remain in Hopi gravesites. At the end of the week a summary of students' responses was posted, along with a sample of supporting explanations of their choices. A weekly dilemma calls on them to think outside of themselves, while calling on their own personal experience to make informed decisions.

As with any trip, time, distance, cost, location, and supplies are important things to be aware of.

Figure 1. Example of AmericaQuest Daily Data

GPS position:	35° 36 minutes N 106° 20 minutes W
Sunrise:	5:54 AM
Sunset:	6:25 PM
Dental floss used:	133 ft.
Toilet Paper Used:	407 ft.
Pictures Taken:	4608
Miles Biked:	260
Miles Hiked:	52
Flat Tires Fixed:	3
Ailments:	Fatigue, sliver in Dan's finger

The America Quest expedition team has placed a variety of data within the context of the expedition. Figure 1 shows an example of the team's daily postings (Buettner, 2000b). This authentic data, both serious and whimsical, is provided as a resource for study of geography, weather, health, measurement, and mathematical computation. The numbers have meaning within the context of the quest, whereas traditional approaches often stretch to create context for manipulation of data.

Personal, archaeological, biological and anthropological information are presented within the expedition team's posted journal entries. A weekly entry by the team biologist, called "Gross and Disgusting," described items that attract the attention of students but also address issues of a biological nature (2000). For example, the team biologist's entry on March 9, 2000 discussed the discovery of road kill.

" The other day I was … searching for mule deer. I came around a corner and there … was my first animal!

As I got closer I saw it was a cat but it was so bloated and putrid that I didn't want to get too close. (Allen, 2000)

She goes on to discuss what kinds of animals are more likely to become victims of road kill and why, and that bacteria is largely responsible for road kill clean up. It's easy to see that both the topic and language can pull the reader in, drawing attention to what's "gross" and away from the challenges of reading.

In the case of road kill, the team biologist asked students to think about the issue of road kill in Arizona and apply what they'd learned to the entire United States. She polled them on how the United States should reduce the road kill problem. The expedition experience gave the students a structure upon which informed opinions could be made. Situated cognition may also help with the transfer of problem solving skills to new situations (CTGV, 1993).

Multimedia is a major supporting factor in the America Quest experience. Each weekly Kid Profile, for example, included a video of the host student and a recording of them speaking or singing. In some cases they were speaking in the Navaho language. As virtual members of the expedition team, they can experience more closely what the team in the field is experiencing. Another aspect of the audio-visual nature of the quest site is that it supports the varied learning styles of the participants and provides cues for students who may have learning difficulties.

Brown, Collins and Duguid stress the value of the enculturation of the learner into the domain, or content (1989). By observing the members of the new culture, in the case of the America Quest expedition team, archeologists, anthropologists and biologists, students can learn the behavior and language of the field experts. The environment encourages student interaction with the adult experts as well as with other student team members. Students can communicate through email, message boards and occasional scheduled chat rooms.

Collaboration and cooperation are key characteristics of an anchored learning environment (CTGV, 1993). Real world problems are solved in environments where many people contribute to the search for solutions. Complex problems often necessitate the input of many. Students with weaker skills can contribute to the process while they benefit by learning from their peers. The process of problem solving within a group, requires articulation of thought. Students must be clear about their thinking. When posting to the site, the America Quest team chose models of articulate thought, what they referred to as the most interesting questions and responses, to post on the bulletin board. They are able to view good models of communication.

The America Quest experience also builds a sense of community. At each location the team selects a student for the Kid Profile to be interviewed and introduced on the website. Students often have misconceptions about people from different parts of the world or from different cultures. The Kid Profile helps children develop some global awareness and cultural sensitivity. Profiles include information about the student's family, daily routine, school day, personal interests and goals. Students can relate to another child's experiences, and can see the world from a different perspective. This experience can change a student's, and even a teacher's, global awareness.

The Challenges of Quests in the Classroom

Adoption of a new instructional approach is a challenge for any classroom teacher. Accountability for standardized test scores makes it difficult to shift attention from mandated curriculum schedules. For many, a cultural shift also needs to take place in the classroom. Teachers and students must move from the more traditional didactic to a more process oriented learning approach (SCOPE, 2001).

Research has shown that successful adoption of innovations is dependent on six factors: relative advantage, compatibility, complexity, trialability, observability and reinvention (Rogers, p.15-16). Adopters must perceive that the new technology has a relative advantage over the usual way of doing things. Teachers must believe that the quest experience offers enough value to justify modification of mandated curriculum. They need time to explore the quest and talk to other teachers who believe in the quests' value.

Teachers considering participation in a virtual quest, want to know if this new learning environment is compatible with their own their personal values about education. Teachers who favor problem-based, student-centered and process oriented approaches may be best suited for virtual quests. The complexity of an innovation has an impact on its adoption. Innovations perceived as too complex or difficult to understand are less likely to be successfully adopted. A teacher approaching a quest for the first time must be comfortable with the technology and its management in the classroom. They must decide which quest experiences to use, what instructional focus to choose, and how much time to. Trialability is another factor impacting successful adoption. It gives the uncertain adopter an opportunity to experiment, and become comfortable with the new technology. Teachers have the opportunity to visit archived virtual quests on the Quest Channel at Classroom Connect's website prior to the expedition (www.classroom.com), or to visit the quest website before the quest starts. Important, particularly to adoption of any innovation in the educational setting, is the degree to which the impact of an innovation is observable to others, i.e. teachers, parents and administrators. Improved student motivation makes the adoption of innovation more likely. Once an innovation is adopted, if the adopter is able to modify or reinvent the innovation to customize it to their needs, then it is more likely to continue to be used. Quests, such as America Quest, are designed so that the breadth of the experience and resources leaves room for teachers with varying student or curriculum needs to make decisions about what they will focus on and how it will be used. The more often a teacher participates in quests, the more familiar they become with its components and the more easily they can customize the experience for their students.

The introduction of the virtual quest into the classroom environment brings with it the issue of teacher readiness to use technology as an instructional resource. Roger's model for adoption of innovation touches on this issue when considering the adopter's perception of innovation's complexity, i.e., whether or not the teacher is technically ready to integrate technology into the instructional process. According to Sandholtz, Ringstaff and Dwyer, adoption of technology integration happens in five stages: entry, adoption, adaptation, appropriation and invention (1997).

Teachers at the entry stage are struggling with learning how to operate computers and are more likely to rely on teacher directed activities away from the computer. At the adoption stage, teachers have developed some personal skills with computers and begin to show some interest in integrating technology into their lessons. Teachers at these stages may find a virtual quest overwhelming, and are least likely to participate.

It's in the last three phases that change in instructional practices begins to take place. In the adaptation phase, teachers begin to realize that computers can save time, that students are highly motivated and, therefore, more productive. As teachers develop confidence in and mastery of their own technical skills, they begin to realize the natural association of technology and work. At this stage, appropriation, students are working at the computer more, interacting more collaboratively and are more involved in project-based learning. At the height of the integration continuum is the invention stage. It is at this point teachers have moved to a more constructive approach to learning in the classroom, have begun to question more traditional teaching approaches and are frequently collaborating with other teachers. It seems that teachers at these last three stages would be most ready to consider participation in virtual quests, particularly those in the invention stage. Their collaborative and project-based classrooms are well suited for anchored instruction.

In 1993, the Cognitive and Technology Group at Vanderbilt (CTGV) revisited their 1990 classroom implementation of the Jasper Woodbury series and looked at the challenges of teaching an anchored curriculum. They noted that one of the greatest challenges for the teacher was the shift in their role as provider of information to coach.

Teachers in CTGV's research group questioned the value of the Jasper series activities and wondered where it fit into their curriculum. They also worried that taking their students out of the mandated curriculum for a month would impact their achievement test scores. CTGV found that achievement test results of participating students were equal or better than those students that did not participate (CTGV, p. 58). The Classroom Connect quest experiences are designed with national curriculum standards in mind and should make their acceptance as supporting local curriculum easier.

Anchored instruction, problem-based learning and virtual quests lend themselves to portfolio and performance based assessment (SCOPE, 2001 & CTGV, 1993). Virtual quests, such as America Quest, have assessment opportunities built in; the Weekly Quiz is an online review of the event of the week; performance-based rubrics are available in the Teacher's Lounge; and suggestions for developing student portfolios can be found in the teacher's guide.

Students, too, who are used to a more didactic approach to learning, may not know how to participate in a learning environment that is more process oriented and where the path to solving problems is less clear. Used to working as individuals, the shift to cooperative learning may take some training and practice.

In conclusion, virtual quests are excellent examples of learning environments that engage students in real-world problem solving in authentic settings. Research has shown that students engaged in situated, anchored learning environments performed as well as or better on standardized tests than the control group (CTGV, 1993).

Issues of virtual quest adoption in the classroom, however, include consideration of a teacher's readiness to try an innovative approach to instruction, their perception of its compatibility with their teaching style, the ability to which he or she can try it out, see how well it works and modify it to fit their curriculum and instructional style. Because virtual quests are by nature technologically supported, adoption readiness is also contingent on the teachers' level of technology adoption. Teachers who are comfortable with technology themselves and as a classroom resource are more likely to find that virtual quests fit in their classrooms.

Methodology and Results

The 2001 MayaQuest expedition was conducted with six elementary school teachers from the author's school. The teachers registered their classes at the Classroom Connect web site and were committed to incorporate MayaQuest as part of their instructional day. These six teachers were then interviewed about their instructional characteristics, issues surrounding the use of quests in the classroom, and their level of comfort with technology. Although conducted as objective research, the author's enthusiasm for the topic introduced some subjectivity. One fifth grade teacher chose to pair up with a third grade teacher and held a peripheral role in the daily planning. All six teachers agreed to the interviews, which lasted 25-45 minutes and were conducted during their planning time. The MayaQuest project was in its second and third week when the interviews were started.

The interviews were audio taped, transcribed and coded in reference to the three focus areas for this study: 1) teacher instructional characteristics including their comfort with and use of technology as an instructional tool, 2) student outcome as a result of the MayaQuest experience and 3) issues surrounding successful implementation of the quest in the elementary classroom.

Each classroom at Sawnee Elementary School has 5 networked, Internet accessible multimedia computers. Each teacher has her own multimedia notebook computer with a video card that allows for projection to the classroom TV, and that is also network able. In addition, there are three mobile mini-labs that contain ten notebook computers per cart. These notebooks have a wireless connection to the network. Students shared the notebooks or worked individually in an activity center arrangement.

Teacher Instructional Characteristics

All teachers taught regular classrooms that included four fourth grades, one third grade, and one-fifth grade classroom. Three of the teachers had tried previous Classroom Connect virtual quests with limited success.

When asked about their comfort level with technology as an instructional tool, on a scale from 0 (no comfort) to 5 (total comfort), 5 teachers in the group placed themselves well above average (4-5) and one teacher rated herself as average (3). (See the chart below.)

Table 1.Characteristics of Teachers Participating in the Study

Teacher	Grade Level Taught	Years Teaching Experience	Prior Online Project Experience	Technology Comfort Self Rating Out of 5	Self-stated Role in Student Learning	Student Desk Grouping
Anne	3	7	No	4	Facilitator	Groups
Betty	4	11	Yes	4	Guide	Groups
Carol	4	11	Yes	4.5	Facilitator	Groups
Diane	4	4	Yes	4	Facilitator/ Direct Instruction	Rows
Edith	4	5	No	5	Facilitator/ Direct Instruction	Rows/ Grouped
Faye	5	25	Yes	3	Manager	Rows

As a result of classroom observation and experience working with these teachers, this author would rate their apparent comfort with technology about the same as or slightly higher than they rated themselves.

The teachers were asked about their approach to instruction, i.e., what they saw as their role in student learning. Ann and Carol defined their role as facilitators. Betty referred to herself as a guide. Faye, on the other hand, referred to herself as a manager. All of the teachers stated that they used cooperative group work as part of their normal daily instruction. Diane and Faye said that they used cooperative group work either weekly or bi-weekly. Edith noted that she used computers more often after the beginning of Maya Quest.

Cooperative group work in a classroom is best facilitated by a desk arrangement that allows for ready communication. Within a week of starting the expedition, Edith had rearranged her classroom to four desk groupings.

Betty, Carol and Diane mentioned that they had attempted previous Classroom Connect quests with limited success, and Betty described her past experience (AmericaQuest 2000) as "overwhelming."

All teachers indicated that prior to MayaQuest their students used computers for word processing, i.e. journaling, letter writing, cooperative story writing and research reports; all took advantage of *Encarta Multimedia Encyclopedia* '97 and the Internet; and several used notebooks/TV connections for whole group demonstration.

Throughout the year Betty, Carol, Diane, Edith and Faye used Power Point presentations for morning announcements that were projected on the classroom TV. These included reminders of what the students should do when they arrived in the classroom, journal prompts, and learning center management. Several also created hyperlinked learning centers, for example, creating a single slide to explore electricity and magnetism by linking to several related websites (students rotated through the computers stations with this teacher created focus sheets).

Looking at these teachers' level of adoption of technology in reference to the ACOT model none, it is possible to place them loosely along the continuum of growth. Faye's instructional emphasis placed her in the adoption stage, whereas Anne, Carol, Diane and Edith style of instruction placed them at the Appropriation stage.

Student Outcome

Each of the teachers was asked to comment on student outcome, as a result of MayaQuest participation. Several noticed an increase in the students' independent use of technology. Students developed independent problem solving skills through use of the Mystery Photo. For example, the "Mystery Photo" is a picture of an object taken at close range so that its size and context are questionable Students were asked to guess, or infer, what it was with the least number of clues. Betty explained:

> "Of course, the kids love the Mystery Photo... We looked at it, we got our clues...and we still didn't have a clue what it was. But they knew it was some kind of plant. It said it wasn't a bush, so they guessed it was some kind of tree. And then it said something about ants. So, then I showed them how they could go into the Quest library and start looking for websites about plants and helped them to come up with what do we need to look for...We had to look in several places, and they found the tree. They couldn't WAIT to get over to the computer to write their answer...they'll call me over, I found it! I figured it out! Instead of them just guessing and seeing what the answer is, which is what mine did in the past because I didn't do it that way and show them how to find the answer. They're getting so much better at research skills, on the Internet sites, on the Encarta sites. They're skimming for information."

Increased student motivation was noticed by all of the teachers. Betty noted that her class would be so involved in what they were doing that they would forget to go to lunch. Anne, a third grade teacher, noted a student who had come into third grade barely reading at all who was able to read MayaQuest entries and "state five facts he'd read." She also stated that reading this type of text, i.e., expository text helps to "...train the reader's eye, to read for understanding."

Edith used words from the quest for the weekly vocabulary. Faye had observed her students reading the journal entries on the quest website and that "...they read through the text with vocabulary I know they don't know but continued to read anyway to get the gist of what they were saying."

Several teachers noted that learning curricular content in the context of the quest helped students to make connections to their learning. Betty and Carol used ecosystems as their focus. Betty said,

> "They're talking about producers. They're talking about consumers and ...they're using it in conversation now. They read something about an animal...I guess it was about the termite eating rotten wood and I heard them say, 'Oh, so that's a decomposer.' They're making the connection."

All of the teachers commented on the importance of the realism and opportunities for decisions making that are part of the quest experience. Their participation in the quest

> "...was not just a scenario in a book. It's real. Someone's really talking to us and thinking we're important. They think that what we have to say matters. And these fourth graders, they feel so important. That they want to hear what their vote is and that they make a difference." [Betty]

The Kid Profile had a particular impact on their students. The students were most intrigued by Alfredo, a 9year-old shoeshine boy in Guatemala who has lived on his own for 3 years (Buettner, 2001). These teachers did a compare and contrast activity comparing basic characteristics of their lives and Alfredo's. The difference was "stark," as Carol put it.

Table 2. Teacher Selected Curricular Focus for MayaQuest

TEACHER	Science	Social Studies	Math	Language Arts
Anne	Animal classification	Reading maps and charts, communities, compare/contrast	Gathering data, graphing	Expository writing, reading for facts
Betty	Ecosystems, food webs	Reading maps, charts, latitude & longitude, compare/contrast	Gathering data, graphing	Journaling, writing research reports
Carol	Ecosystems, food webs	Reading maps, charts, latitude & longitude, compare/contrast	Gathering data, graphing	Journaling, writing research reports
Diane	Animal classification, weather			Writing research reports
Edith	Animal classification, weather	Reading maps, charts, compare/contrast	Gathering data, graphing	Writing research reports
Faye		(Mentoring)		Reading expository text

Issues Surrounding MayaQuest Implementation

During the year of this study, teachers had access to 5 classroom computers, a teacher laptop and three mobile notebook computer carts available on sign out from the media center. When asked what would keep them from participating in future quests, Betty and Carol stated that access to the technology would be a major factor.

Table 2. Teacher Selected Curricular Focus for MayaQuest

All teachers mentioned the need to find a curricular focus for the quest (See Table 2). Several teachers felt pressure to meet the established curriculum and prepare for the standardized tests.

In response to this perceived pressure, however, some teachers noted that their students learned helpful content and skills in preparation for standardized testing. Betty noted that,"If I hit these objectives [the QCC's] through the quest, they're going to like it better…if I can find the right [curricular] focus I can do any quest."

Assessment of student outcome was an issue raised by several of the teachers, even though no question addressed it directly. "Can I assess all of their growth in understanding of the world, their communication? No!" [Anne] Portfolios, rubrics and use of the quest's on-line quizzes, however, were ways that most of the teachers measured student growth.

Discussion

Teacher and student response to the MayaQuest experience was uniformly positive. Teachers spoke excitedly about their students' response to the experience and about their own enjoyment with teaching with MayaQuest. Comments throughout the five weeks included how engaged the students were and how ordinarily reluctant learners were participating fully. They remarked that their students made connections between their newly introduced content skills and the quest experience. At the end of MayaQuest, all participating teachers agreed that it was a valuable experience that they plan to repeat the following school year.

The teachers in this study were all relatively experienced; even the least experienced had taught for four years (see Table 1). As a result, they had a good understanding of school culture, curriculum management, the Georgia QCC's, and basic classroom management. Their self-proclaimed comfort level with technology was relatively high. These teachers were well along the continuum of technology adoption as defined by Sandholtz, Ringstaff and Dwyer's model (1997).

All of the teachers said that given adequate resources, they would sign up for another quest. For these teachers, learning best takes place in an environment that is interdisciplinary, involves authentic problem solving, is collaborative and supports skill development. Some teachers have found previous quests to be overwhelming. However, once they determined a curricular focus, they looked at the quest's complexity more as a rich resource than a roadblock. Betty, Carol and Diane had tried previous quests. This certainly helped them with understanding what was involved. They all reviewed the teacher's guide thoroughly before starting and Anne said that this was key in her finding the focus for her instruction. Key to their final adoption of MayaQuest, and possibly future quests, was their 1) ability to reinvent or modify the experience to fit their instructional style and curricular needs and 2) the impact that it had on their students' academic growth.

Perhaps the most significant common instructional characteristic of these teachers was how they defined their role in student learning. They proclaimed themselves as facilitators focused on creating a learning environment for their students rather than simply imparting information or delivering curriculum. They actually verbalized a preference for an interdisciplinary approach to instruction, i.e. teaching in this manner helped students make connections across the curriculum.

Their classroom-learning environment regularly included student to student and student to teacher collaboration and cooperation. They recognized the classroom as a community of learners and organized student activities with that in mind daily.

All of the teachers used the classroom desktops, and Anne, Betty, Carol and Edith also used the student notebooks to support MayaQuest. Classroom student assistants, called TechnoBuddies, were responsible for pick up, setup, troubleshooting, break down and return of the notebook carts to the media center. They developed independence from daily technology use, which made it possible for the teacher to focus on facilitating the various classroom activities. In the classroom, students worked in pairs, or sometimes individually at the computer to interact with the MayaQuest web page, do research or publish their Power Point presentations, reports and journal entries. Because these teachers supported collaboration, their students' skills with both the technology and the content grew. The students frequently learned technical and content information from each other.

Key to the success of MayaQuest for these teachers was access to the technology. All but Diane and Faye noted that if they had not had access to the notebooks on a daily basis, that the impact of the MayaQuest experience would not have been as great. There was new information on the site daily, and because there was so much that was interesting, both the students and teachers felt a need to keep up with team's adventures. Daily access also allowed for students to respond daily to journal postings, continue research, draft, revise and produce quality responses to their learning. Missing a day was not a choice they wanted to make. When asked if they would do MayaQuest with just the five desktops in their room, the teachers said that they would, but felt that fewer students would be able to interact with the site daily or produce the same quantity or quality of work. As Betty said, "They have to touch it everyday or you lose them."

The teachers' view of students as part of a community of learners and their willingness to participate in MayaQuest demonstrated a broad view of education. They all had the established curriculum to teach and goals to meet but were flexible enough in their view of education to be able to blend these goals into the quest experience. Curricular focus was very important to their adoption of the quest, and as Betty stated, "If I can find the curricular focus I can do any quest."

The MayaQuest 2001 experience was an excellent example of anchored instruction. Students were placed in a learning environment, or macrocontext, that was truly authentic. They worked with a team of field experts over a period of time to find clues about the mystery of the fall of Mayan civilization, a complex problem with few clear answers. Students worked as practitioners. They shared their research and theories, collaborating not only with their classroom peers, but also with students around the world and with field experts. Considered part of the research team, their input was valued, which added to the authenticity of their participation.

The most significant outcome of the MayaQuest experience for these teachers was the impact that it had on student learning. According to the teachers, student response to MayaQuest was unanimously positive. Even students considered to be at risk, were excited enough by the content that they seemed to forget that they were reading, writing and doing mathematics. Teachers noticed increased scores on vocabulary tests, increased reading comprehension and writing production. Anne's third grader, a non-reader at the beginning of the year, was reading web site postings and able to state facts about what he'd read during the quest. All teachers noted that student critical thinking showed growth, as evidenced by improved problem solving and journal reflections.

The range of topics and the authenticity of the issues blurred the boundaries between mathematics, science, reading and so on. Aided by their teachers, and often independently, students made connections to curricular goals and applied new learning to a real context. Students meeting children through the Kid Profile were often moved by their counterparts' lifestyle and easily made connections to their own lives certainly developing a broader global view.

Implications

Those teachers who view themselves as classroom facilitators of student learning, take a flexible approach to instruction, have a clear direction in terms of curricular goals, and prefer to help students make connections to learning and real life through an interdisciplinary approach to learning, are more likely to adopt virtual quests. Teachers with well-developed and frequently used technology skills are also more likely to tie quests into curriculum goals. The results point toward these teachers as the best candidates for successful quest experiences.

Teachers, who participate in a virtual quest for the first time, might be encouraged to speak with other teachers who have participated in previous quests. Communication could happen through the Classroom Connect Quest Channel where previous and current quest bulletin boards are available for teachers.

The high level of student motivation, increase in student work production, and good work, cannot be ignored. It is the most exciting outcome of virtual quest participation. By their nature the quests' adventure, authenticity and interaction with the quest team in the field, are so engaging that students seem to learn without realizing it. The teachers in this study noted that the amount and type of reading that their students were doing, i.e. daily high level expository reading, writing, and the development of their students' critical thinking skills through quest activities, did more to prepare their students for standardized testing than did drill and practice. The students developed skills that were transferable to new academic settings.

Access to technology as part of virtual quest success was an issue brought up by teachers in this study. Although they had five networked multimedia desktops in their classrooms, four of them felt that the high level of student achievement was related to the daily use of the additional ten wireless notebook workstat ions. The implications are that teachers with less technology access will find quest implementation more challenging.

Further Research

The results of this study lead to some new questions for further research. First, would a larger sample of interviewees show the same teacher characteristics for quest participants? Second, would a sample of teachers who do not know the author provide different results?

The next step for this study would be to measure student outcome more quantitatively. How, and how much, does student achievement increase as a result of participation in a virtual quest? Student data on language arts, mathematics, science, social studies and critical thinking skills prior to and following quest participation would give data for comparative study. Standardized test scores of students participating in the quests might be compared to those who use drill and practice preparation.

Final Comments

This study demonstrates the value of the anchored instructional approach to learning, as represented by MayaQuest. Student participants in this study were highly engaged, motivated, and appeared to benefit from increased skill development and work production. Students experienced models of problem solving, teamwork, thought processes and language in an authentic manner, not just as a scenario developed to simulate reality. That authenticity was made possible by access to the technology, bringing the field experience into the classroom while transporting students to the field.

Adoption of virtual quests can motivate and rejuvenate teachers, but certain teachers are also more likely to adopt virtual quests. They are teachers who value a student-centered approach, view themselves as facilitators of learning, are flexible enough to modify the prescribed curriculum to fit the quest experience, and who are comfortable with technology.

Virtual quests are a promising instructional approach. It is not recommended that a school or district adopt them globally. Rather, teachers should be given the opportunity to adopt or not adopt virtual quests. It is also important that they be provided both technical and instructional support as needed. For the appropriately oriented teacher, anchored instruction, in the form of virtual quests, is a very exciting addition to the learning environment.

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Self-Efficacy and Self-Directedness:
The Impact on Student Satisfaction in Distance Education Courses

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Abstract

A popular belief is that a learner's degree of self-directedness impacts the success of students learning at a distance Also conceivable is that self-efficacy may affect student satisfaction in distance courses. Additionally, satisfaction may help to identify success in distance education students. However, the relationship between these variables has yet to be explored. In the summer of 2001, subjects enrolled in web-based courses were surveyed to determine their self-directedness and self-efficacy and general satisfaction with their learning experience. Results of the statistical analyses and suggestions for future research are discussed.

Introduction

It is a widely held believe that a learner's degree of self-directedness plays a role in the success of students learning at a distance (e.g. Kearsley, 1995, Major & Levenburg, 1999, Moore, 1986). It is also thought that perceived self-efficacy may have an effect on student satisfaction in distance courses (Clark, 1999, Schneider & Reinhart, 1995). Additionally, satisfaction may be important in identifying future success of distance education students (Simonson et al, 2000).

The relationship between these three variables has yet to be explored. In particular, the relationship between perceived self-efficacy, self-directedness and satisfaction in a web-based course may play a major role in whether or not a student enrolls in courses at a distance, continues with study in a on-line degree program or recommends such courses/programs to other students. This could have far-reaching implications for distance degree programs and administration considering such programs.

Purpose of the Study

There were several purposes for this study. The first was to determine whether there is a relationship between perceived self-efficacy and self-directedness in students enrolled in an on-line Masters program. A second purpose was to ascertain whether there was a relationship between perceived self-efficacy and satisfaction. The third purpose was to determine whether there is a relationship between self-directedness and satisfaction. The fourth was to discover whether either perceived self-efficacy or self-directedness played a role in student satisfaction.

Subjects

Subjects were graduate-level students enrolled in two separate web-based courses: "Foundations of Instructional Technology" and "Advanced Technology in HPER" (Health, Physical Education and Recreation). Subjects in Foundations of Instructional Technology are working toward a Master of Science in Instructional Design and Technology. Subjects in Advanced Technology in HPER are working toward a Master of Science in Health, Physical Education and Recreation. Both Masters programs are fully on-line degree programs at the same midwestern university. Both classes are taken near the beginning of coursework in each respective major.

Methodology

The survey was a combination of three separate assessments: a perceived self-efficacy psychometric instrument (Jerusalem and Schwarzer), a self-directedness questionnaire (Guglielmino) and a survey designed to measure satisfaction with the subject's own learning and satisfaction with the learning environment (Summerville). Subjects were surveyed in the fifth week of a six-week summer course. Subjects were sent an e-mail message requesting that they take a survey to help future students who take courses at a distance. This survey consisting of eighty-eight individual items.

Instrumentation

The Generalized Self-Efficacy Scale

The Generalized Self-Efficacy Scale is a 10-item survey designed in 1981 by Jerusalem and Schwarzer to assess perceived self-efficacy. It was originally developed in the German language and subsequently translated into thirteen different versions. The measure was tested for each version and the Chronbach alpha for the English version was .90. It is available on-line at http://userpage.fu-berlin.de/~health/selfscal.htm.

Self-Directed Learning Readiness Scale

The Self-Directed Learning Readiness Scale was designed by Guglielmino to measure a subject's readiness to engage in self-directed learning. The SDLRS has been used by hundreds of organizations, translated into more than 14 languages and used in more than 90 dissertations since its development in 1977. Permission was given by the author to use the survey in an on-line format. This researcher tallied the number of surveys received and the author received compensation for each survey completed by the subjects.

Summerville Satisfaction Questionnaire

A satisfaction questionnaire was developed for administration in a doctoral dissertation (Summerville, 1997) and adapted for use in this study. Questions were designed to determine if students were satisfied with the learning environment, were comfortable with the learning environment, and to self-assess learning from the experience. For every question, an equal and opposite question was written to ascertain which wording best asked the question to be answered (e. g., "I liked learning via the Internet" vs. "I did not like learning via the Internet"). Two statistical consultants evaluated the questions for face and construct validity. These questions were then pilot tested with a group of approximately sixty subjects and subsequently scored to determine how effective the instrument was at measuring satisfaction. Finally, the completed satisfaction instrument was subjected to a Cronbach's Coefficient Alpha and a factor analysis to establish statistical validity and reliability. The resulting Coefficient Alpha for the satisfaction questionnaire was .89.

Data Collection

Data collection began during the fifth week of a six-week summer course. The subjects were sent an email message detailing the purpose of the study, requesting subject participation and the message included the URL of the combined survey. Due to the agreement reached with the author of the Self-Directed Learning Readiness Scale, the subjects were given 48 hours to complete the survey before it was removed from Internet. The surveys were returned by CGI server to the researcher via e-mail. There were twelve useable surveys returned.

Analysis Procedures

Returned surveys were collected and data was coded for analysis by this researcher. SPSS Statistical software was used for analysis. Due to the unknown relationship between The Generalized Self-Efficacy Scale, the Self-Directed Learning Readiness Scale, and the Summerville Satisfaction Questionnaire, a Pearson Correlation was used for analysis on the total scores for each subject on each instrument to determine if there was a correlation between the instruments. If a relationship was found, a stepwise regression procedure would be used to determine if either the Generalized Self-Efficacy Scale or the Self-Directed Learning Readiness Scale impacted satisfaction.

Analysis of Pearson Correlation

A Pearson Correlation procedure was used to determine if there was a relationship between total scores on the perceived self-efficacy, self-directedness and satisfaction instruments, as measured by the combined survey. The result of the procedure is as follows:

		Perceived Self-Efficacy	Self-Directedness	Satisfaction
Perceived Self-Efficacy	Pearson Correlation	1.000	.770**	.322
	Sig. (2-tailed)	.	.003	.308
	N	12	12	12
Self-Directedness	Pearson Correlation	.770**	1.000	.577
	Sig. (2-tailed)	.003	.	.050
	N	12	12	12
Satisfaction	Pearson Correlation	.322	.577*	1.000
	Sign. (2-tailed)	.308	.050	.
	N	12	12	12

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Analysis of Stepwise Regression

ANOVA from the Regression Model for Independent Variable Self-Directedness and Dependent Variable Satisfaction

Model	SSQ	DF	MSQ	F
Regression	253.572	1	253.572	4.978*
Residual	509.344	10	50.934	
Total	762.917	11		

*Denotes significance at 0.05 level

Perceived self-efficacy was not found to be a significant predictor of satisfaction in this model.

Future Research

Since there was a significant correlation between self-directedness and student satisfaction and degree of self-directedness was found to be a significant predictor of student satisfaction, this researcher plans to investigate the relationship further. Additionally, since perceived self-efficacy and self-directedness were so highly correlated, the relationships between those variables will also be investigated to a greater degree.

In particular, this researcher plans to survey other students enrolled in on-line courses but use a different schedule for survey administration. The perceived self-efficacy and self-directedness surveys will be administered at the beginning of the semester while and the perceived self-efficacy survey will be readministered and satisfaction survey will be administered at the end of the course.

In the future, this researcher plans to develop prescriptions for helping students with low perceived self-efficacy and/or low self-directedness scores have a geater degree of satisfaction with their own learning. Additionally, the relationship between satisfaction and achievement may also be explored and, if warranted, prescriptions will be developed for students with difficulty in these areas.

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Characteristics of Job Corps Students: Their Relationship to Training Completion and Job Placement

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Abstract

This study examined the learner characteristics of enrollees in the Job Corps training program. The independent variables in this study were length of time out of school, age, gender, ethnicity, and scores on the Tests of Adult Basic Education (TABE). The dependent variables were training completion, job placement and training completion time. Research questions investigated the relationship between the independent and dependent variables. Data for all variables was obtained from the US Department of Labor, and represented 70,049 enrollees from July 1, 1996 through July 1, 1997.

Results of the study indicate older students who have more training prior to enrolling in the Job Corps and those who score higher on the TABE have higher training completion and job placement rates. Success in these two outcome variables was achieved by over half of all enrollees. The strongest finding of the study is the impact of literacy training on the outcomes under investigation.

Identification of learner characteristics is a prominent step in various instructional design models (e.g., Dick and Carey, Reigeluth, Jonassen and Hannum, Morrison, Kemp & Ross). Despite this step being emphasized, a review of the literature in the field of Educational Technology reveals very few studies in this area. Recommendations for further research are included.

Overview

Instructional design experts have consistently advocated the investigation of learner characteristics prior to the design and development of instruction so that these characteristics can inform the design process. In this study, the researchers investigated learner characteristics of at-risk learners enrolled in a large, federally funded vocational training program, the Job Corps, to determine if a relationship existed between certain learner characteristics and student success in the program. The researchers examined extant data related to learner characteristics that is routinely collected by the Job Corps when students enter the program. The intent was to determine which of these characteristics were related to success in the Job Corps vocational training program.

Instructional design models typically provide information on examining learner characteristics. It is one of the early steps in the Dick and Carey (2000) instructional design model, a model widely used in the field of Educational Technology. The authors provide much detail related to gathering and analyzing learner characteristics, and how these characteristics should then drive the design of instruction. This need to have learner characteristics serve as the basis for instructional design is echoed by Reigeluth (1999), Jonassen and Hannon (1995), Morrison, Kemp & Ross (2001), as well as many other instructional design experts.

Purpose of the Study

The purpose of this study was to examine the characteristics of at-risk learners who participated in the U.S. Department of Labor's Job Corps program. The independent variables in this study were those characteristics the student had upon entering the program as collected by the Job Corps. These variables were: (a) length of time out of school, (b) age of the student upon entering the program, (c) gender, (d) ethnicity, and (e) entry-level academic skills as measured by the Tests of Adult Basic Education (TABE). The dependent variables were: (a) whether the student completed the training (training completion), (b) whether the student was placed in a job (job placement), and (c) the length of time students took to complete the program (training completion time).

Review of the Literature

The at-risk adult learner has many obstacles to success: traumatized, often unstable backgrounds, low literacy levels, and a lack of faith in the educational system being able, or willing to meet their needs. The negative impact of these obstacles is the limitation of economic achievement for this group.

The workplace qualifications of at-risk adults are in stark contrast to the needs of business. Gone are the days of low-level jobs where minimal skills were acceptable. The current and future needs of business call for literate workers who can function as a part of a team, who can access and analyze information, and who can function independently with little supervision.

In order for at-risk learners to participate in the workplace of the future, they require remedial training in basic skills and vocational training. This training cannot effectively take the form of traditional training, for the traditional style of training has failed this group in the past. A different educational setting is required that can accommodate the unique needs of this group, where the instruction is individualized and self-paced, yet structured and supportive. The Job Corps provides this kind of opportunity.

Research Questions and Methodology

The Job Corps was chosen for this study because it targets youths who are economically and educationally disadvantaged. Job Corps training centers offer basic education leading to a high school diploma or GED and vocational skills training. The 70,049 records used in this study represented all Job Corps enrollees from July 1, 1996 to July 1, 1997. Data for the study were supplied by the U.S. Depart ment of Labor. There were five research questions that guided this study:

1. Do length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in English and math discriminate between Job Corps students who complete training and Job Corps students who do not complete training?
2. Do length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in both English and math discriminate between Job Corps students who are placed in jobs and Job Corps students who are not placed in jobs?
3. Is there a relationship between length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in both English and math for Job Corps student who differ on training completion time?
4. Is there a relationship between the Tests of Adult Basic Education (TABE) English scores and training completion, job placement, and length of time to complete training?
5. Is there a relationship between the Tests of Adult Basic Education (TABE) math scores and training completion, job placement, and length of time to complete training?

The first two questions were investigated using discriminate analysis. Research Questions 3, 4 and 5 were investigated using multiple linear regression.

Results

The results of the discriminate analyses for Research Questions 1 and 2 indicated that the five independent variables were all predictive of students completing training and being placed in jobs. The results of multiple linear regression for Research Questions 3, 4, and 5 indicated significant relationships between all of the independent variables and training completion time. In other words, significance was found for all independent variables in their relationship with the dependent variables in this study.

Discussion of the Results

In this study the most important learner characteristic to emerge was literacy level. Many at-risk individuals are unable to secure jobs paying more than minimum wage because they don't have the literacy levels to understand business documents. Business documents can be written memos, training manuals, reference lists, emails, inventory documents and financial statements. Communication flounders when literacy skills are weak or missing. Poor communication skills negatively impact success in the workplace.

The data indicated that enrollees who scored 600 or more on the TABE English or math tests were more likely to complete training. This group, functioning at the 2nd grade literacy level, possesses some foundational skills that can be enhanced through remediation. The results of this study also contradict a common misconception that if a people cannot read by the third grade, they are probably unwilling or unable to learn. As Knowles stated, people learn when the training is relevant. By combining vocational training and literacy training, the Job Corps establishes this relevance.

One issue regarding high school diplomas or GEDs and their relationship to literacy is necessary to understand the success of the Job Corps program. The presence of a diploma or GED does not necessarily mean that the student is highly literate. At the Job Corps all enrollees are tested, and if an enrollee has a high school diploma or equivalency and still scores below the 8th grade 5th month on the TABE, remediation is prescribed. It might be worth stating the 8th grade 5th month literacy level is important because that is the level at which most business correspondence is conducted. Newspapers, popular magazines, government forms, publications, and other types of documents are written at this level. Other programs with which this researcher is familiar do not strive to move the literacy level of program participants to this 8.5 level which is typically required to be successful in the workplace. As a result, it can be inferred that one of the hallmarks of the Job Corps success is the fact that students complete the program with a solid literacy level required by employers.

The Job Corps is not currently training knowledge workers. It may be necessary for this program to examine what it would take to train individuals to compete in the new economy. Certainly, higher literacy levels and problem solving skills are necessary in order for Job Corps participants to gain entry into the knowledge workforce. This workforce commands higher salaries which in turn contribute to a higher standard of living. In the future, the Job Corps program may want to consider raising their literacy standards and provide the training necessary to produce knowledge workers.

The Job Corps, through testing and remediation, stands as an excellent example of how learner characteristics can be exploited at the front end of a training program in order to achieve success at the end of a training program. The future success of the Job Corps program may hinge on its ability to produce knowledge workers for the new economy.

Recommendations for Further Research

The identification of learner characteristics needs to be more rigorously addressed. Variables examined in this study are those collected by the Job Corps and are demographically oriented. Case studies might reveal additional learner characteristics not discussed in this study. One possible method would be to select several Job Corps enrollees with different entry skills and literacy levels and conduct a series of comparative case studies. These could include thick descriptions of their experiences in the training program and how their learner characteristics impact these experiences. Observations, interviews, identifying key informants--perhaps instructors or mentors involved closely with the subjects--as well as journal records and demographic data could be used as data sources for the case studies.

One aspect of particular interest to this researcher is the residential component of the Job Corps, and its effect on training completion. There are several day program sites in the Job Corps where enrollees report every day to training as they would to a job. A study that might be informative from a program design standpoint would compare a residential program with a day program to see whether there is a difference in their impact on success.

Several longitudinal studies are suggested by the results of this research. Studies could be designed to compare programs that emphasize literacy training with programs which do not emphasize literacy training. How do their program participants fare over time? Are there comparable job placement rates? Are wage rates comparable? Again, the long-term employment outcomes of participants may provide information that could then be used to enhance program design.

Conclusions

The independent variables in this study--length of time out of school, age, gender, ethnicity and scores on the Tests of Adult Basic Education in English and math--were examined to determine if a relationship exists between those characteristics and training completion, job placement and length of training. Data provided by the US Department of Labor contained records for 70,049 enrollees who participated in the Job Corps from July 1, 1996 through June 30, 1997. The relationships between these variables were tested using discriminate analysis and multiple linear regression. Results of these statistical tests indicate a relationship between entry characteristics and training completion. The data also highlights the importance of combining literacy training with vocational training, especially for those individuals who have been classified as at-risk because of their low literacy skills.

The data in this study support the importance of investigating learner characteristics and allowing that knowledge to drive the program design. A review of literature reveals an acute shortfall of studies that investigate learner characteristics and their impact on program design. This researcher recommends that practitioners of instructional design focus more attention on this aspect of the design process.

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Instructional Design Issues Facing E-Learning: East Meets West

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Abstract

The rapid emergence of e learning in business and industry has been accompanied by a number of problems when instructional design concerns are incorporated into the overall curriculum development.

This paper examines two distinct geographical extremes of Shin-Ju, Taiwan and Central Florida to see if, when comparisons are made, there appear any issues in common to both locations and cultures.

Background:

The first company is located in Shin-Ju, Taiwan. It is one of many diverse high tech manufacturing companies located in the Shin-Ju Science Center. The major manufactured products are computer components. Their clients range from distribution channels in Taiwan and beyond on a worldwide basis. There are several thousand employees at the Shin-Ju location, with the following workforce demographics:

Males: 60%   Females: 40%
Nationality: 100 % Taiwanese
Average Employee Age: 28
Average number of years employed at the company: 1-2 years
Average education level of employees: Bachelor's degree

The second company is in Lake Mary, Florida with corporate headquarters in Germany.
There are several thousand employees located at the Lake Mary plant with the following demographics:
Males: 60%   Females: 40%
Nationality: Diverse, i.e. Hispanic, American-born Caucasian, African-American, Asian, Northern European, etc. with a majority being American-born Caucasian.
Average Employee Age: 34
Average number of years employed at the company: 5-10 years
Average education level of employees: High School diploma-Two year's college
The Florida corporation has ISO 9000 Certification.

The Taiwanese company has a top-down management style that maintains stringent accountability and performance standards. Employees have a three-shift daily 24-hour production line quota that is enforced. If the production line fails to meet piecework numbers and a random sampling of quality levels exceeds a specified percentage, the line is shut down until the problem is corrected.

The Florida company tolerates a specified percentage of rework numbers and, should this number increase beyond tolerances management is on the floor investigating the cause. The management structure reflects a "Northern European" work ethic relative to stringent cleanliness, time on and off the clock, and attention to detail. It is also top down but participatory in nature.

The Issues and Statement of the Problem

In the Shin-Ju company two basic quality management tools are in place to assist in the efficient operation of the plant. These tools are: Quality Control Seven Tools (QC 7) which involves analysis of tasks related to Zero Defects, Significant Milestones, Statistical Process Control, etc. and a Failure Mode Effectiveness Analysis (FMEA) table that tracks and analyzes production line failure.

The Florida company bases its analysis on identified ISO 9000 standards for quality control of all production line task rates. In both instances, management mandates the use of both analysis tools and production standards and the degree to which they are actually used in practice varies considerably.

Degrees of variance relate to the employee's understanding of the necessity to use such tools, their perception of value in using them, and the inherent motivation accorded the employee. Courses on how to use the management tools were unsuccessful. During formal classes offered as to how to use the tools, it was found both management and production line employees did not understand them.

A Potential Solution

In both companies, employee training as a possible solution the problem was addressed. It was felt that if sufficient training could be provided, the management tools already in place would be used.

The Taiwan organization has been provided with a curricular plan based on a new instructional design model devised by the lead author through a series of formulae and matrices that, once training elements are identified, provide management with a specific action plan.

The Florida organization began its training analysis by first looking at its workforce demographics and capabilities. A first step was the provision of basic communication and mathematic skills for the line-workers, thus the beginning of *"Project Gold"*.

Issues from the East

This project focused on updating training needs and building a web based learning support system. A year after the system was adapted in this manufacturing company a reduction was found the number of employees who participated in web-based training. Each employee is required to take at least take one course via web based training but many finally quit learning from the web.

An interview and survey was conducted about the web based training issues from employee and management. It was found that employees are willing to participate in web training courses, the Internet access is good, and each course is well designed. The connection between courses was the problem. For example, in the quality control class, learners did not have the requisite statistics back ground to successfully complete the class. When the employees enrolled in the quality control class, there was no English class provided to assist learners in reading the English menu or to operate machines that have English control panels.

Finding the training needs

The worker-oriented, job-oriented, and cognitive task analyses were performed as tools for determining the required skills, knowledge, and abilities of employees to accomplish the required tasks and for developing the trainingcurriculum.

Worker-oriented Task Analysis

The purpose of the worker-oriented task analysis is to determine the knowledge and skills of employees. The process of worker-oriented task analysis includes interviews and discussions with employees, job tasks performance observations, review of tasks by management, and surveys to specify the knowledge and skills needed for accomplishing tasks (Clifford 1994).

Job-oriented Task Analysis

Job-oriented task analysis is used to collect procedural knowledge related to specific tasks required for each job. This analysis relies on employees and supervisors who can clearly state the job task sequence step-by-step (Texas Higher Education Coordinating Board 1995).

Cognitive Task Analysis

Cognitive task analysis involves observation and worker interviews and is a process used to gather information on worker behavior in problem solving (Llorente 1996).

The second focus of the project was building a web based learning support system that constructs a cognitive map to depict the amount of training needed. The training offered on the web contains approximately 2000 courses such as statistical process control, quality control tools, and specialized problem-solving skills and skill required for machine operations. The "map" is able to help learners to obtain direction as to the large number of courses, and shows both the pre-requisite and advanced courses.

The core principle of the learning support system

The learning support system employs characteristics found in our Interpretive Structure Model. "The Tangible product of an Interpretive Structure Model exercise is a structural model called a "map" which is, in general, a multilevel structure. In condensed form, the structure is a hierarchy" (Warfield, 1977). From the cognitive map learners have a visualized concept that shows the course structure and the hierarchy of courses, thus enabling learners to track their learning path and direction without getting lost. The following information illustrates the core principles that allow the computer to automatically develop the graphic structure of training courses.

Step one: Determine the training needs.

From the figure 1, the "1" represents the specific department and the following 1.1, 1.2, 1.3, 1.4 numbers represent the four assembling lines under department "1". Training needs determined through worker, job, and cognitive task analyses, are depicted as Q_1, Q_2, Q_3...Q_{ijk} as shown in figure 1.

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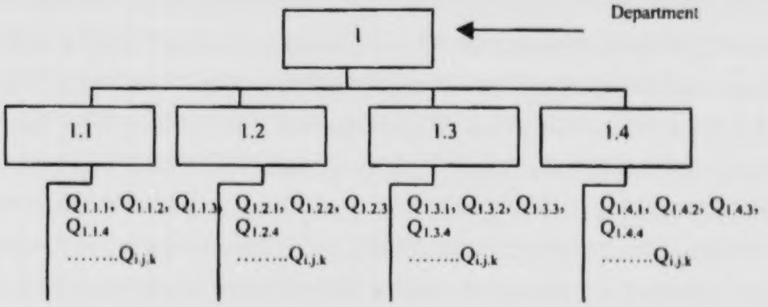
Department
1
1.1
1.2
1.3
1.4
$Q_{1.1.1}$, $Q_{1.1.2}$, $Q_{1.1.3}$, $Q_{1.1.4}$ ....$Q_{i.j.k}$
$Q_{1.2.1}$, $Q_{1.2.2}$, $Q_{1.2.3}$, $Q_{1.2.4}$ ....$Q_{i.j.k}$
$Q_{1.3.1}$, $Q_{1.3.2}$, $Q_{1.3.3}$, $Q_{1.3.4}$ ....$Q_{i.j.k}$
$Q_{1.4.1}$, $Q_{1.4.2}$, $Q_{1.4.3}$, $Q_{1.4.4}$ ....$Q_{i.j.k}$

Fig. 1. Needs assessment

Step two: Forming the system matrix

This step compares every course or learning objective with every other course or learning objective in the matrix to identify any subordinate relationships. When completed, a system matrix that embodies the subordinate relationships between and among the courses and learning objectives is the result.

No.	Course Course	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Q1						?								
2	Q2	?					?								
3	Q3	?	?		?		?		?						
4	Q4	?	?				?					?			
5	Q5			?						?					
6	Q6														
7	Q7												?		
8	Q8			?		?				?					?
9	Q9										?		?		
10	Q10														?
11	Q11									?	?				?
12	Q12														
13	Q13									?					?
14	Q14									?	?		?		

Fig. 2. System matrices

Step three: The rationalizing procedure. The system matrix is then transferred to connected matrices.

This step is intended to determine the number of system matrix hierarchies. The aim of the rationalizing procedure is to produce a set of matrices called *connected subordination matrices*, each of which represents one hierarchy.

$$A = \begin{bmatrix}
0&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&0&1&0&1&0&1&0&0&0&0&0&0\\
1&1&0&0&0&1&0&0&0&0&1&0&0&0\\
0&0&1&0&0&0&0&0&1&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&0&0&0&1&0&0\\
0&0&1&0&1&0&0&0&1&0&0&0&0&1\\
0&0&0&0&0&0&0&0&0&1&0&1&0&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&1\\
0&0&0&0&0&0&0&0&1&1&0&0&0&1\\
0&0&0&0&0&0&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&0&0&1&0&0&0&0&1\\
0&0&0&0&0&0&0&0&1&1&0&1&0&0
\end{bmatrix}$$

Step four: Transfer connected matrices to reachable matrix

Definition $B = A + I$

Where A = Connected matrices

I = Identity matrices

[Boolean factor]

0+0=0 0x0=0
0=1=1 0x1=0
1=0=1 1x0=0
1=1=1 1x1=1

reachable matrix

$B.B \ldots B^{n-1} = B^n$

reachable matrix: $T = B^n$

[Generating matrix]

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \times \begin{bmatrix} a' & b' \\ c' & d' \\ e' & f' \end{bmatrix} = \begin{bmatrix} a \cdot a' \oplus b \cdot c' \oplus c \cdot e' & a \cdot b' \oplus b \cdot d' \oplus c \cdot f' \\ d \cdot a' \oplus e \cdot c' \oplus f \cdot e' & d \cdot b' \oplus e \cdot d' \oplus f \cdot f' \\ g \cdot a' \oplus h \cdot c' \oplus i \cdot e' & g \cdot b' \oplus h \cdot d' \oplus i \cdot f' \end{bmatrix}$$

Generating matrix

$$B = A + I = \begin{bmatrix} 0&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&0&1&0&1&0&1&0&0&0&0&0&0 \\ 1&1&0&0&0&1&0&0&0&0&1&0&0&0 \\ 0&0&1&0&0&0&0&0&1&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&1&0&0 \\ 0&0&1&0&1&0&0&0&1&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&0&1&0&1&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&0&0&1 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&1&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&0 \end{bmatrix} + \begin{bmatrix} 1&0&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&1&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&1&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&1&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&1&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&1&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&1&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&1&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&1&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&1&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&1&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&1&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&1 \end{bmatrix}$$

$$= \begin{bmatrix} 1&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&1&1&0&1&0&1&0&0&0&0&0&0 \\ 1&1&0&1&0&1&0&0&0&0&1&0&0&0 \\ 0&0&1&0&1&0&0&0&1&0&0&0&0&0 \\ 0&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&1&0&0&0&0&1&0&0 \\ 0&0&1&0&1&0&0&1&1&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&1&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&1&0&0&1 \\ 0&0&0&0&0&0&0&0&0&0&0&1&0&0 \\ 0&0&0&0&0&0&0&0&1&0&0&0&1&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&1 \end{bmatrix}$$

$$B^5 = B \times B = \begin{bmatrix} 1&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&1&1&1&1&0&1&1&1&1&1&0&1 \\ 1&1&0&1&0&1&0&0&1&1&1&1&0&1 \\ 1&1&1&1&1&1&0&1&1&1&1&1&0&1 \\ 0&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&1&0&0&0&0&1&0&0 \\ 1&1&1&1&1&1&0&1&1&1&1&1&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&1 \\ 0&0&0&0&0&0&0&0&1&1&1&1&0&1 \\ 0&0&0&0&0&0&0&0&0&0&0&1&0&0 \\ 0&0&0&0&0&0&0&0&1&1&0&1&1&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&1 \end{bmatrix} = T \text{ (reachable matrix)}$$

Step five: Transform reachable matrix to hierarchical matrix

[Definition]

s_i: the number of the element

$R(s_i)$ reachable set

$Q(s_{ij}$

$R(s_{ij}$ $Q(s_{ij}$

[Example]

$s_i = 1$

$R(s_{ij}$: 1 6

$Q(s_{ij}$: 1 2 3 4 5 8

$R(s_{ij} \cap Q(s_i)$: 1

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	s_i	$R(s_{ij}$	Q $(s_{ij}$	$R(s_{ij}$ n Q (s_i)
Level1 T	1	1 6	1 2 3 4 5 8	1
	2	1 2 6	2 3 4 5 8	2
	3	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	4	1 2 4 6 9 10 11 12 14	3 4 5 8	4
	5	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	6	6	1 2 3 4 5 6 8	6
	7	7 12	7	7
	8	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	9	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
	10	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
	11	9 10 11 12 14	3 4 5 8 11	11
	12	12	3 4 5 7 8 9 10 11 12 13 14	12
	13	9 10 12 13 14	13	13
	14	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
Level2 T'	1	1	1 2 3 4 5 8	1
	2	1 2	2 3 4 5 8	2
	3	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	4	1 2 4 9 10 11 14	3 4 5 8	4
	5	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	7	7	7	7
	8	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	9	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
	10	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
	11	9 10 11 14	3 4 5 8 11	11
	13	9 10 13 14	13	13
	14	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
Level 3 T''	2	2	2 3 4 5 8	2
	3	2 3 4 5 8 11	3 5 8	3 5 8
	4	2 4 11	3 4 5 8	4
	5	2 3 4 5 8 11	3 5 8	3 5 8
	8	2 3 4 5 8 11	3 5 8	3 5 8
	11	11	3 4 5 8 11	11
	13	13	13	13
Level 4 T'''	3	3 5 8	3 5 8	3 5 8
	4	4	3 4 5 8	4
	5	3 4 5 8	3 5 8	3 5 8
	8	3 4 5 8	3 5 8	3 5 8
Level 5 T	3	3 5 8	3 5 8	3 5 8
	5	3 5 8	3 5 8	3 5 8
	8	3 5 8	3 5 8	3 5 8

Fig. 3. Hierarchy Analysis

Step six: Transform the hierarchy matrix to the Interpretive Structure Model

In this step the task is to produce a cognitive map and graphic hierarchy structure among courses or learning objectives. After this step, the "map" automatically generates by computer and is displayed on the web page. Learners will have a visualized concept on the course structure and the hierarchy of the course and be able to track their learning path and direction without getting lost.

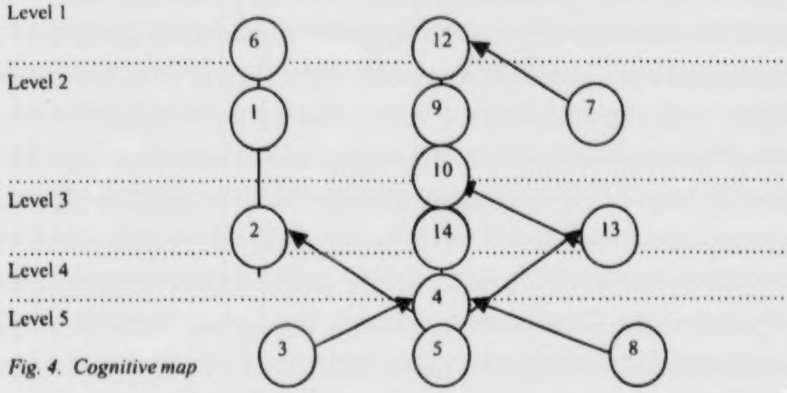

Fig. 4. Cognitive map

Issues from the West

The global corporate climate in which American businesses find themselves competing today requires a high workplace rich in skills and technology. Today's manufacturing workforce requires continual training to keep abreast of technological advances. Today's corporations need flexible people, trained in many different functions (specialized training with cross training).

Technology waits for no one! It is progressing at warp speed, and workers (especially production workers) are hard pressed to keep up. Multinational manufacturing companies are working toward gaining or retaining global standardization of product quality (ISO 9000,QS 9000, etc). What happens to a worker with low basic skills and an inability to train rapidly enough to keep pace with these changes? They are lost during downsizing or merger. It is usually the least educated workers in low-end manufacturing jobs that become unemployed first and remain so for the longest amount of time. While many people consider the 1990-1991 recession to have been the first white-collar one, it hit minorities and low-skilled workers especially hard. They ended up getting clobbered and the least educated employees got clobbered once again. (Hilsenrath, September 2001)

A survey by the Gallup Organization for the National Federation of Independent Business found that two-thirds of companies of the 260 polled said they have gone without needed skilled employees. More than half said they had to cut work hours, limit production or turn away business. Many companies have told researchers that the softening market now allows them to be more selective in hiring than they were last year. (Grimsley, August 2001) Most organizations agree that letting less-productive workers go and replacing them with better-skilled ones during a time of economic crisis is an opportunity they are quick to use to their advantage. Current employees are increasingly aware of this situation.

Management Plays a Vital Role In Training

Management plays a vital role in for it sets the tone when it comes to employee training and professional development. Management teams of many American companies have already begun to align their training programs with the company goals and to follow the human resource management practice continuums. They are attempting to progress from short to long-term term focus, from narrow to broad application, from a productivity emphasis to quality of work life emphasis, from spontaneous, unplanned training to a planned, systematic one, from individual orientation to group orientation, from low participation to high participation and from zero employee involvement to a higher degree of involvement. (Evans & Lindsay, 1999, pp. 290-3)

In America companies, motivational focus is usually on rewards and recognition. They establish minimums for promoting cooperation, create or modify recognition systems, compensation systems, and mechanisms for broadening employee responsibilities. They create education and training opportunities for employees to learn and use skills that go beyond current job assignments through the redesigning process. They form relationships with educational institutions to continue to develop employees – thus, ensuring a supply of well-prepared employees. They actively seek employee involvement. However, depending on the type of management in the organization, the degree of employee involvement varies widely. The table below depicts levels of employee involvement.

Level	Action	Primary Outcome
1. Information sharing	Managers decide -- then inform employees	Conformance
2. Dialogue	Managers get employee input - then decide	Acceptance
3. Special problem solving	Managers assign problem to specific employees	Contribution
4. Intragroup problem solving	Intact groups meet to solve it.	Commitment
5. Intergroup problem solving	Cross-functional groups solve problems	Cooperation
6. Focused problem solving	Intact groups deepen involvement in specific issue	Concentration
7. Limited self-direction	Teams function full time with Supervision	Accountability
8. Total self-direction	Executives facilitate self-management in All-team Company	Ownership

*Source: Copyright@ Jack D. Orsburn, Linda Moran, Ed Musselwhite, and John H. Zenger, Self-Directed Work Teams (Burr Ridge, IL: Business One Irwin, 1990), p. 34. All rights reserved.

Increased employee involvement results in empowered employees who have the wisdom to know what to do and when to do it, possessing both the right motivation and tools. This requires significant change in work systems within companies. Employees must be provided education, resources, and encouragement from management. However, empowerment also means that managers must be willing to relinquish some power. This power shift often creates fears in management that workers will abuse their privileges. Experience usually shows that front-line workers generally are more conservative than their managers. (Evans & Lindsay, 1999, pp. 290-3)

Experience has shown that feedback to management is vital from the facilitator or educational institute providing the training,. With computer-assisted instruction and e-learning, this task is easier because monthly reports on employee training progress (generic progress – all names and vital information are omitted) can be sent to management on a regular basis.

Employee Motivation Plays an Important Role in Training Programs

Students in basic skills updating training programs report an immediate boost in self-esteem. As they set and meet goals, it is not long until a habit is formed and transferred to their own lives in the workplace and at home. Facilitators report comments such as, from an older student, "I enjoy coming to class because it helps me stay more mentally alert". Students realize that they get increased respect at home because they are now able to help their children with their homework. Supervisors report seeing an increased confidence and professional development focus that soon becomes an incentive to volunteer for additional training or responsibilities. Motivation for specific skill training is easier to generate because once employees comprehend "what's in it for them" they are excited about learning.

In order to motivate employees and managers of an organization, trainers or facilitators must establish a sound professional relationship with the company management and patiently attempt to spark the interest of the workers. Listening and being sensitive to their needs can aid in this task. If it is a manufacturing firm, understand that downtime is money lost. Being open to creative scheduling can be a big help – both for meetings with management and classes. Motivational flyers and pamphlets can be produced and strategically placed around the plant and open houses can be held with specific times set aside for questions and answers.

Examples of Successful Training Programs

In 1993, American production workers found that without continual training, they were unable to adequately meet the challenges of rapidly progressing technology, global competition, and corporate mergers. *Project Gold* was a three-year Federal Workplace Education Grant aimed at these production workers. Collaborative partnerships arose between a community college, a private non-profit organization, and a mid-size telecommunications equipment manufacturing plant in Central Florida. This project was only a small part of a nationwide collaborative effort to assist companies in addressing a lack of American global competitiveness.

This project was unique in that it had a dual focus: One part was a computer-assisted instructional learning center to update or enhance basic skills. In this center, PLATO and *I Speak English* software was used: PLATO for the basic skills, as well as for some specialized problem-solving skills such as Statistical Process Control (SPC) and *I Speak English* for the English as a second language students (ESL). Another example of training received in the learning center was GRE preparation. A residual benefit to *Project Gold* was that all of these students become quite skilled at working on computers. This was a plus that the company had not considered.

The procedure was the following:

1. Students would enter and receive the Test of Adult Basic Education (TABE) in order to assess their basic skill levels.
2. PLATO would draw up an individualized education plan (IEP) for each based on their specific needs.
3. They would then commence their self-paced training with regular progress reports being generated – which proved to be very motivational to the students, as well as to management.
4. On-the-job follow-ups were then carried out, as meetings were set up with management to discuss visible results.

The second focus of the project was on customized training geared specifically to meet industry needs. First, a certified job profiler conducted a job analysis though interviews, surveys, plant tours, and meetings with subject matter experts (SME's) and task analysis. A customized curriculum was created and methods and strategies selected, as well as securing the best media, materials, and instructor. Finally, creative scheduling was undertaken. Given that timing is everything in manufacturing, we worked closely with management in designing a training program that would not cause undue scheduling stress. Some examples of customized training offered in this project were Bright Ideas (creative problem solving), American Production and Inventory Control Society (APICS I & II), Statistical Process Control (SPC), teamwork, Regular Problem Solving, HAZCOM, and New Technology Training.

A second collaborative program was being conducted simultaneously with Project Gold. It was the *Electronic Technology Advanced Program (ETAP)* that involved a partnership with the manufacturing plant, the public school system, and a community college.

ETAP was a dual system combining theory with practice that originated in Germany a hundred years ago. It begins with basic skills and knowledge and progresses to a highly technical level. The *ETAP* program includes a "Pre apprenticeship" program for high school students that were tied to the "Tech Prep" initiative. The second was an apprenticeship program for community college students to obtain an Associates of Science Degree in Electronic Engineering Technology, an electronic industry certification, and Government Certification.

ETAP was designed to search find qualified, highly motivated high school students, and offer them a scholarship and hands-on applied training. Then upon graduation, accept them into the actual program where they would then be paid for two On-the-job-training periods and receive tuition and fee reimbursement for a two-year Associate Degree – all of this with the ultimate goal of employment within this company. The program would enable students/employees to compete using globally benchmarked world-class standards with recognized credentials, train in critical manufacturing technologies and customer service, and train an incumbent new work force, existing workforce, and instructors/mentors.

Virtual Universities

Today the world is rapidly turning toward electronic learning. Virtual universities are popping up everywhere: Florida, California, Kentucky, New Jersey, Israel, Germany, and Canada to name a few. The manufacturing plant where the two above-mentioned programs operated also has a virtual university. Employees can be motivated to learn if they understand that it will possibly increase job security. It was proven with *Project Gold* and the ETAP program successfully proved this concept in our high schools and community colleges. *ETAP* is now called *ACE-NET* involving the same partnership but now it leads to an AS degree in Computer Engineering Technology.

This educational history of this manufacturing company has led up to the E-learning that is now taking place. Workers can still attend the basic skill updating classes at the community college. However, today, this company has a *Virtual University* of its own. *Their goal during 2001 is to convert at least 60 % of all training programs to either Computer Assisted Instruction (CAI) or E Learning.* Next year, *the goal is for 75% and finally 100% in 2003*! Thus, as is readily apparent -- *Technology* marches on!

Conclusions

We have examined two organizations, one in the east, a second in the west. Both faced training issues that impacted line-employees where communication and work-related skill assessment and development were key to their future success. Management issues accompanied the decisions as to what training needs were and the basis upon which such decisions would be made. Despite being separated by oceans and miles, the problems encountered were identical while the proposed solutions differed only in their complexity. Both solutions were designed to achieve success on the part of all, with quality control being the common element. The progress made in the Florida scenario paid off with results that not only are being continued, albeit in another location, but amplified within the organization as well. The jury remains out in the instance of the Taiwanese manufacturing plant until sufficient time elapses to test the model as proposed.

As has often been concluded in the past, while cultures may differ, the basic issues related to e-learning, training as a whole, and employee demographics are often far more alike than different. This, we feel, is an accurate reflection of today's rapidly advancing techno-economy.

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Visual Testing: Searching for Guidelines

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Abstract

An experiment was conducted to investigate the influence of the variables 'realism' and 'context' on the performance of biology students on a visual test about the anatomy of a rat. The instruction was primarily visual with additional verbal information like Latin names and practical information about the learning task: dissecting a rat to gain insight in the anatomy of a mammal. Students were tested on: (a) recognition of anatomical objects, (b) labeling of these objects and (c) relations between objects. Results indicate that the amount of realism and context used in the text influences test performance depending on the learning tasks. Test results also show a learning hierarchy in the different learning tasks with the recognition task being the easiest and the relations task the most difficult.

Introduction and the Context of the Problem

In several courses that are taught in the faculty of Biology at the State University of Groningen in the Netherlands, it is considered necessary that students learn about the anatomy of a mammal by dissecting the body of a rat. The students perform this task in a two-day practical in which they dissect dead animal material (the rat) layer by layer to identify the different anatomical structures such as the different muscles and organs. This practical will always exist in this way as the faculty staff takes the firm position that the students need the experience of the stepwise dissection of a real rat to gain thorough understanding of these anatomical structures. Careful dissection of the animal enables the student to examine every part of the rat in detail and to get a grip on what they have to learn.

The problem occurred due to the teaching approach in which the students had to report about their observations by making anatomical drawings of the anatomical structures according to drawing rules that were part of the instructions of the course. The drawings of the anatomical structures had to depict all parts involved with their relative proportions and their interconnections, together with the Latin names of the parts in a legend in the margin of the drawing. After two days work, each student had produced a set of drawings of a rat. The problem was that a limited number of staff members had to correct the work of large numbers of students. There are about 150 students yearly, distributed over two courses for first-year biology students and second-year pharmacy students, who produced about ten drawings each. The correction of these drawings is so time consuming, that the students sometimes had to wait for months before they get feedback on their performance. This situation was educationally undesirably. Further the variety of drawing skills of the students introduced a subjective element in accepting or rejecting a drawing as a correct presentation of a given anatomical structure. Moreover, different members of the teaching team put different accents while rating student performance. Uniform evaluation of the drawings could therefore not be guaranteed. This situation was highly unsatisfactory. So the problem was that the variety of the students drawing skills leads to a subjective judgment. Besides this the spread of the correction work over several teachers caused a non-uniform evaluation and last the students received delayed feedback.

These limitations resulted in the need of the teaching staff to look for other possibilities for assessment. That need motivated this research project. The identified assessment problem is, however, more general than the problem with the drawings in the particular practical about the anatomy of the rat. The learning outcomes that have to be assessed are largely in the visual domain (the anatomical parts and their relative positions and interconnections), which led to the choice to study the assessment problem on a more general level in the field of visual testing. The concrete problem of the practical about the anatomy of the rat will then be used as the test bed for that study.

Visual learning - Visual testing

In searching for alternatives for the assessment on the basis of student drawings, the construct to be learned during the instruction had to be redefined. According to Cronbach and Meehl (1955) "a construct is some postulated attribute of people that is assumed to be reflected in test performance. In test validation the attribute about which we make statements in interpreting a test is a construct". In the case of the anatomy of the rat the construct to be learned consists of (a) the decisive visual characteristics of anatomical objects like shape, size, texture and color of the object, (b) the spatial relationships between the objects and the relative size of each object in relation to other objects, (c) the verbal labels and descriptions of the objects, and (d) the functional relationships of objects. This construct is essentially visual, whereby the verbal labels and descriptions extend the qualities of the construct into the verbal domain, allowing for verbal communication about the spatial structure and its components

The definition of the learning construct resulted in the definition of learning tasks for the instruction. After following the course, the students should be able to (a) recognize the different anatomical structures, (b) label each structure by its Latin name, (c) specify their spatial orientation and (d) specify their functional interconnections. The learning outcomes can subsequently be assessed by requiring the students to demonstrate that they are able to fulfill three tasks: (a) the recognition task, (b) the labeling task, and (c) the relations task. In the recognition task the students must recognize the correct object according to its visual characteristics. In the labeling tasks the students has to identify an object by its Latin name. The relations task is a task in which the student has to show understanding of the spatial relations between objects by their functionality.

Although the instruction is primarily visual, it is relevant to know whether the assessment should also be visual. According to the stimulus generalization theory (Hartman, 1961) learning increases as the testing mode approximates the mode in which the information was presented. Dwyer (1978) gave an example in which he stated that instruction presented via a visual modality but evaluated in a conventional pencil-and-paper assessment would probably not provide an accurate representation of the total amount of learning that has occurred. The effectiveness of instruction presented to the students through a visual channel might most appropriately be measured by employing criterion measures assessing contributions of the visual mode of instruction.

As in all learning also in visual learning the more complex contructs contain concepts and relationships that are hierarchically ordered. Smith and Ragan (1999) summarized theories about learning hierarchies which all prescribe a similar pattern: learners first should be able to recognize a concept in order to identify that concept by its name. The acquired concepts then form prerequisites for more difficult tasks such as problem solving. Dwyer (1978) made a distinction in phases in a learning hierarchy for visual learning, starting with facts and definitions in a content area that are familiar to a person. In this way the person is prepared to relate and combine known and new elements to form new concepts. The more concepts a person possesses, the easier it is to form generalizations and rules. These processes are again prerequisites for problem solving. Dwyer (1978) states that: "the implication to be derived from the concept of a learning hierarchy is that since there are different kinds of educational objectives there also are different kinds of learning, each requiring students to perform different kinds of activities and each possessing unique conditions for optimum learning to occur". This assumes that in designing a visual test, it is required to look more closely to the type of item format that will assess these different kinds of learning in a valid way. In this case, the recognition task of the visual concepts is a prerequisite for identifying that concept with the correct name. Together they are prerequisites for the relations task.

Item types

For visual testing, Dwyer (1978) designed the PSE-test (PSE: Program of Standardized Evaluation) in which he tested the learning effect of instruction given verbally with additional visualization versus verbally alone. The subject of instruction is the anatomy of the heart. The test consisted of four parts: (a) a terminology test, (b) an identification test, (c) a drawing test and (d) a comprehension test. The terminology test measures the students knowledge of specific facts, terms and definitions. The identification test measures the students ability to identify parts or positions of an object. The drawing test measures the students ability to construct and/ or reproduce items in their appropriate context and the comprehension test measures the students understanding of the heart, its parts and its internal functioning. These four tests combined form an overall test for measuring the student's total understanding of all the content material. The identification test, terminology test and comprehension test consisted of multiple choice items only. The test items for the comprehension test was the most difficult since they were designed to measure the student's understanding of complex procedures and processes.

The use of multiple choice items is sometimes being criticized. Martinez (1999), for instance, who is also active in the field of visual testing, claims that multiple choice items often elicit low-level cognitive processing. He designed constructive figural response items (CFR) which would evoke complex thinking and therefore be more appropriate for testing the student's understanding of complex procedures and processes (Martinez, 1994). These items differ from traditional items in two ways: (a) they require mental construction of a response, rather then selection among options, and (b) they require demonstration of proficiency in a figural medium. Martinez (1990) argued that comparison of multiple choice items with their figural constructive response counterparts showed that CFR items were more difficult, more discriminating and more reliable. Martinez (1999) argues that the use of CFR items is best for items that evoke complex thinking. Other research outcomes (Martinez & Jenkins, 1993) were that CFR items were better able to distinguish between novices and experts. CFR items are sometimes referred to as free response or open-ended items.

Martinez (1993) and Parshall, Davey and Pashley (2000) recognized the fact that as technology improves it becomes more useful in visual testing because it gives possibilities to innovate item formats for visual testing by using objects and media in item formats. This may bring an interactive aspect in the item, for instance by requiring students who take the test to scale object size by dragging with the mouse or to move objects to required positions.

Variables for the study

The visual aspects of the construct to be learned are decisive visual characteristics like shape, size, texture and color of the objects. The representation of these characteristics in visuals is affected by the amount of realism of those visuals. 'Realism' is mostly associated with photographic pictures. More schematic representations such as line drawings are regarded to be less realistic, although they may be more effective to articulate certain visual characteristics than realistic pictures do. Dwyer (1978) claims that the effectiveness of realism in this sense depends on the learning tasks and the instructional method. According to Mandler and Ritchey (1977, in: Anderson, 1994), however, people are better in remembering the meaning of a visual then the details of that particular visual. Which would here mean that realism would not add to visual testing because the details are not important since people only remember the meaning. This uncertainty was reason to choose 'realism' as the first variable for this study.

The construct to be learned also contains the recognition of objects with their spatial positions between other objects and the relative size of the objects in relation to each other. The availability of the other objects appears to influence the recognition of objects. Cave and Kosslyn (1993) conducted an experiment in which they speak of 'holistic pictures' when objects are embedded in a visual context. They found that the recognition of objects in holistic pictures resulted in higher mean scores then the scores for isolated objects. Research in the field of face recognition (Tanaka & Farah, 1993) resulted in a similar outcome. Tanaka and Farah demonstrated that recognition of facial components was facilitated by the presence of the facial contour. Isolated facial objects were difficult, in most cases impossible, to recognize correctly.

The results of Mandler and Ritchey as well as those of Tanaka and Farah suggest that 'visual context' is a relevant variable for visual testing. 'Context' was thus selected as the second variable for this study.

Hypotheses

The effect of the variables 'Realism' and 'Context is studied on the basis of three hypotheses. The contradictory results of earlier research about the amount of realism led tot the first hypothesis:

H1: There will be no difference in mean score between items with realistic color pictures and items with schematic drawings.

Hypotheses of this kind have mostly been studied with types of instruction that are primarily verbal with additional visuals. In our case, the instruction is primarily visual.

The variable 'Context' is studied by testing the second hypothesis:

H2: Items with contextual information will result in higher mean scores then items without contextual information.

Hypothesis three is based on the theory of learning hierarchy. The requirement that concepts of anatomical structures have to be learned as a prerequisites for understanding functional relations, lead to the assumption that this letter task is more difficult:

H3: Items testing the relations task will be more difficult then items testing recognition and labeling.

Item formats

Item formats were chosen based on the insights of Martinez (1999) and Martinez and Jenkins (1993) that recognition could be assessed with multiple choice items whereas items requiring more complex tasks such as relating objects based on functional relationships should be tested with CFR items. For the purpose of the study eventually the following item formats were used:

1. Multiple choice items
2. Labeling items
3. Connect-the-dots items

The multiple choice items all contained four alternatives in which the correct object had to be recognized. In the labeling items the examinee had to identify an object by its Latin name which could be chosen from a long list in an index. The connect-the-dots items are examples of CFR items. With the connect-the-dots items, examinees had to make connections between anatomical objects and also give the direction of these connections according to their functionality.

Experimental Design

Figure 1 gives an overview of the 2*2-experimental design in which there were two independent variables being the amount of realism and the context information. For the variable 'Realism' the choice was made to look at the influence of colorful realistic pictures (photo's) of anatomical structures versus the influence of schematic drawings of the same structures. The variable 'Context' was operationalized by looking at the influence of the presence of contextual information versus the absence of context. Figure 1 summarizes the experimental design.

		Realism	
		Picture	Drawing
Context	Yes	Picture + context	Drawing + context
	No	Picture - context	Drawing - context

Figure 1. Independent variables and conditions

De dependent variables are test scores for each of the three learning tasks of the course and a total test score for all test items together:

1. The mean test score on recognition items
2. The mean test score on labeling items
3. The mean test score on relation items
4. The mean test score on the overall test

Method and Procedure

The sample population consisted of 134 first year biology students. The students followed the dissection course for two full days. During these two days the rat was dissected in ten layers. The students were working in groups of thirteen and every student got an own rat for dissection. Before the course each student received a study guide with the instructional objectives and the dissection steps explained according to a cued instruction. The cues that were used in the guide were all Latin names of the anatomical objects that they had to learn. The cued instruction for each dissection layer followed a certain procedure in which the students as a group got a live demonstration of the dissection of that particular layer by a teaching-assistant. The teaching assistant used the Latin names to identify the different anatomical objects, show the important visual characteristics and explain the different functions of each object in accordance to their interconnections. After the demonstration, the students were required to dissect the current layer individually and accordingly observe the anatomical objects. Students had the freedom to take notes during the observation by making drawings of their observations. After completion of the individual dissection tasks, the students were asked to join the group and have a group discussion about the observation with the help of a poster that contained the outline drawing of the dissected layer. Every student had to label at least one anatomical object with its Latin name. At the end of the course on the second day, the student performed a computerized test. The test contained 57 items of which 19 items were based on recognition tasks, 20 items were based on labeling tasks and 18 items were based on relations tasks. The test was specifically developed for the purposes of the experiment. Three groups of questions were designed to measure achievement on the three different learning tasks: (a) multiple choice items, (b) labeling items, and (c) connect-the-dots items. For the picture-version (the realistic version of the variable 'Realism') photographs were taken of all needed visual materials. Image-processing software was used to produce the correct alternative and also the distracters for the multiple choice items, for isolating objects for the no-context-condition, and to add a graphical layer with dots to be connected for the connect-the-dots items. For the drawing-version of the test students of an art school were recruited to make the drawings. The testing program itself was programmed in C++.

Students were randomly assigned to one of the four conditions being: (a) picture with context, (b) picture without context, (c) schematic drawing with context and, (d) schematic drawings without context. At the start of the test, each candidate got an example of each item format to get acquainted with the style of questioning. The results of the test were analyzed quantitatively in SPSS 10.0 by comparison of means, ANOVA, Univariate Analysis of Variance and reliability tests.

Results

Table 1 gives an overview of the results of the univariate analysis of variance on the variables 'realism' and 'context'. The table gives an general overview of the significant differences for every learning task and the overall test.

Table 1. Univariate Analysis of Variance on variables 'realism' and 'context'

	Recognition		Labeling		Relations		Overall test	
	F	Significance	F	Significance	F	Significance	F	Significance
Realism	11.266	.001	2.076	.152	6.727	.011	7.877	.006
Context	38.129	.000	.485	.487	1.762	.187	.811	.370
Realism * Context	36.218	.000	.170	.680	.049	.049	.128	.721

The results are discussed below by realism, context and item difficulty.

Realism

Figure 2 shows the mean scores of the examinees for the condition realism of drawing versus colorful pictures on the different learning tasks and on the overall test. These mean scores are on a scale of 0 to 10.

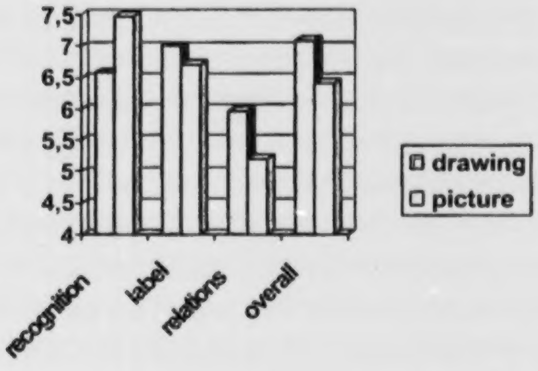

Figure 2. Results of the mean scores on the condition realism: picture vs. drawing.

As can be concluded from Figure 2 and Table 1, there were differences between drawing (for which the exact mean is M= 6.59) and picture (M= 7.48) on the recognition task in favor of picture with a significant difference (p = 0.001). For the labeling task there is a slight difference between the conditions in favor of drawing but this difference is not significant (p = .152). However, the difference found on the relations task between drawing (M= 5.98) and picture (M= 5.19) was significant (p = .011) in favor of drawing and for the overall test the difference between drawing (M= 7.10) and picture (M= 6.42) was also significant (p= .006) and in favor of drawing.

Context

Figure 3 gives an overview of the mean scores for the presence of context versus the absence of context on the different learning tasks and on the overall test. The scale of the mean scores is from 0 to 10.

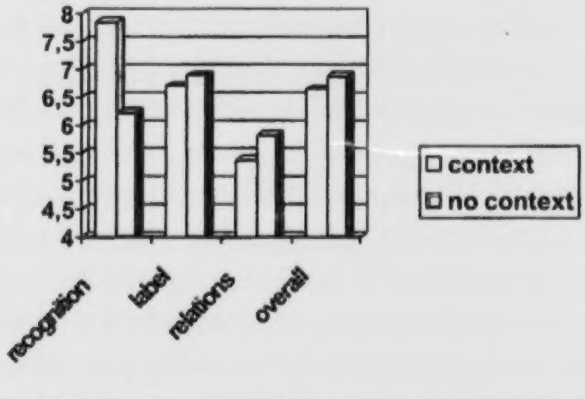

Figure 3. Results of mean scores on the condition context: with context vs. without context

As can be concluded from Figure 3 and Table 1, there were differences between the presence of contextual information in the test where examinees score higher for the recognition of objects (M= 7.84) then in the absence of contextual information (M= 6.21). This is the only significant difference (p = 0.00) that was found. The slight differences that were found for the remaining tasks were not significant which resulted in the overall test also showing no significant differences.

Realism * Context

An interaction effect was found between realism and context for picture (M= 7.48) and the existence of context (M= 7.84) with a level of significant of p= 0.00.

Item difficulty

Table 2 gives an over view on test reliability for Cronbach's alpha and the standard error of mean.

Table 2. Test reliability with Cronbach's alpha and Standard Error of Mean

	Ss	N (items)	Cronbach's alpha	Standard Error of Mean
Overall test	134	57	.8583	.066
Recognition items	134	19	.5873	.097
Labeling items	134	20	.7788	.061
Relations items	134	18	.7113	.097

Table 2 shows that the overall test is reliable with Cronbach's alpha being .8583 and an SEM of .066. The least reliable are the recognition items. Labeling and relations items are equally reliable. Figure 4 shows the item difficulty for the three learning tasks. The scale on the horizontal axis is from 0 to 10 and gives an overview of the proportions of students that answered a particular item correctly on the different learning tasks.

Figure 4 shows a difference in item difficulty with recognition tasks being the easiest and relations tasks the most difficult. Table 2 and Figure 4 complement each other. Figure 4 shows that low reliability of recognition items may be caused by a ceiling effect. The recognition items are obviously rather easy. The more difficult tasks are discriminating much better between learners who know and those who have learned less. The distribution of the items on the scale for the relations tasks shows that this task was the most difficult and the most discriminating. As this task was (thus) also very reliable, the results support the contention of Martinez (1990) who argues that these characteristics are typical for figural-constructive-response items. CFR items seem a proper choice for distinguishing between experts and novices.

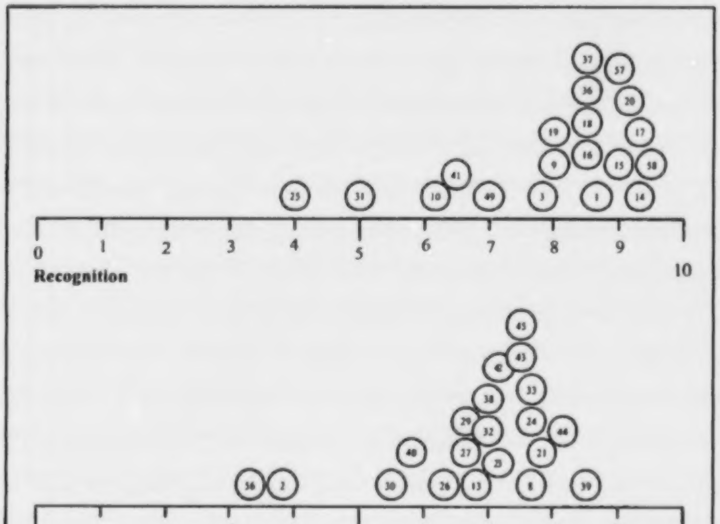

Figure 4: Item difficulty for each learning task

Discussion and Conclusions

Returning to the hypotheses stated earlier in the paper and the experimental results, some conclusions can be drawn on visual aspects of visual testing.

Hypothesis one

The first hypothesis states that we may expect no differences in mean scores between items with realistic color pictures and items with schematic drawings. This hypothesis must be rejected. We did find a significant difference in favor of picture over drawings for the recognition task. Also, a significant difference was found in favor of drawing over picture for the relation task and the overall test. These results suggest possible guidelines which are that for constructs that are primarily visual, it is best to test recognition of objects with pictures and to test relations between objects with drawings. The richer amount of stimuli in pictures thus seems to help recognition of necessary visual characteristics, while for the more abstract relations task, the main characteristics of the objects are sufficient. Drawings can be focused on these main characteristics. These findings comply with the results of Mandler and Ritchy (1977) who found that people are more sensitive to remember the meaning of a visual then the details.

Hypothesis two

The second hypothesis expects that items on contextual information will result in higher mean scores then items without contextual information. This expectation was only true for the recognition of objects. Thus it seems that for recognition tasks the examinees are helped by 'holistic visuals' in the sense of Cave and Kosslyn (1993) to succeed in answering the test items. For the other tasks the isolated objects gave sufficient information to complete the task.

Hypothesis three

The third hypothesis states that the relations tasks will be more difficult then the recognition and labeling tasks. This hypothesis cannot be rejected. The relation tasks appears to be the most difficult one. This finding supports the findings of Dwyer (1978) stating that recognition and labeling are prerequisites for relations. There is also the possibility of Martinez and Jenkins (1993) stating that CFR items are better able to distinguish between novices and experts then multiple choice items which is supported in our results in which the items on the relations task were the most difficult but had a wide spread in scores in contradiction to the items of the recognition and labeling tasks.

The main conclusions of the experiment are that:

1. Anatomical structures were better recognized as picture than as drawings.
2. Drawings yielded better results for test items on relations between anatomical structures than pictures.
3. The results for the overall test favor the use of drawings over pictures.
4. Context helped to recognize anatomical structures.
5. Scaling of item difficulty from easy to difficult shows the following order: Recognition - Labeling - Relations.

As far as guidelines for constructing visual tests are at stake, the results for 'Realism' and 'Context" gave reason for two guidelines:

1. The use of contextual information and color pictures can facilitate the recognition of objects.
2. In order to assess the knowledge of relations between objects based on spatial relationships or object functions, the use of schematic drawings can be sufficient.

In regard to item types, a guideline about CFR items seems to be justified:

1. For visual tests to distinguish between experts and novices constructive figural response items can be useful.

These guidelines need further study to get a more precise insight in the relationships between learning tasks and visual aspects. New technological possibilities for innovative item types, may extend definitions of visual constructs in ways yet to be found. The field of CFR items is thereby interesting as new assessment methods to measure particular constructs are there already technically available. Methods for scoring these items are a challenge and need further research for the development of suitable scoring algorithms. The current study was just a modest step to set the stage for further research on visual tests.

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Student-Governed Electronic Portfolios as a Tool to Involve University Teachers in Competency-Oriented Curriculum Development

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Abstract

At the University of Twente a new curriculum on educational science and technology has been introduced. That occasion was used to try to develop an apprenticeship model in which the students are regarded as young professionals from the very beginning. In that model the students are expected to govern their professional growth by actively collecting evidence of acquired competencies in electronic portfolios. This activity should stimulate teachers to adapt their teaching style to the requests from students for feedback on products that the students would like to put into their portfolios. After three iterations of development in three consecutive academic years, however, the use of portfolios is still not successful. The reasons why are discussed and steps to be taken are suggested.

The Project

The Faculty of Educational Science and Technology at the University of Twente in the Netherlands is educating educational designers with specializations in seven directions: curriculum development, instructional technology, instrumentation (media, computers, and internet in education), educational organization and management, Human Resources Development (HRD), educational testing, and social science research. The Faculty intends to switch to a competency-oriented curriculum for its three-year Bachelor program.

The term 'competency' is partly to be understood in terms of the knowledge and skills that comprise the competency profile of a profession and partly as the ability "...to operate in ill-defined and ever-changing environments, to deal with non-routine and abstract work processes, to handle decisions and responsibilities, to work in groups, to understand dynamic systems, and to operate within expanding geographical and time horizons" (Keen, 1992). Knowledge and skills can be assessed in traditional ways. The kind of behavior as described by Keen is more difficult to observe. This at the same time causes a problem in terms of the extent to which competency in Keen's terms should dominate the whole philosophy and organization of the program. To get around this problem, competency development was seen as an activity that can take place in concert with doing traditional coursework, as long as the students would be able to handle the related learning experiences from a meta-cognitive level that complies with Keen's definition of competent behavior.

The use of portfolios offers a possibility to build evidence of the development of competencies. The main attraction of portfolios is formed by its potential to assess progress and process as essentials for learning (Saywer, 1994). In the new curriculum portfolios are introduced for self-assessment by the students as well as for monitoring their progress.

Starting in the academic year 1999, electronic portfolios were introduced to provide students with a tool for actively working on competency development. The introduction was monitored and the use of the portfolios was developed in a few steps aiming at answering the following question:

"Do student portfolio's yield sufficient support to help students to direct their own development in a competency-oriented curriculum, and if so, under what conditions?"

The literature shows growing consensus that educational reform efforts are doomed to fail unless the teachers' cognitions, including their beliefs, intentions, and attitudes, are taken into account (Haney, Czerniak, & Lumpe, 1996). The introduction of student portfolios is not only planned to serve the purpose of the students, but also as a tool for the implementation of the new curriculum. The latter relates to the readiness and willingness of teachers to adopt a new approach, for which the following question should be answered:

"Does student-directed collection of evidence of professional growth influence teaching style of academic staff?"

The educational concept "initiation in the academic profession"

The new curriculum approach is based on a concept that is labeled: "initiation in the academic profession" (Verhagen, 2000). It is an apprenticeship model in which the students who enter the university directly from secondary school are regarded as young colleagues from the very beginning. A central principle of the concept is that the interaction between students and teachers should take place in a professional context as much as possible instead of interaction in an instructional context. Assignments should as much as possible mirror professional practice to help students to develop professional behavior. The result of a literature assignment should take the form of the literature part of a scientific article; communication products of design assignments such as proposals, budget estimates, blueprints or evaluation reports should take a form that would be appropriate to present to clients; and so forth. Teachers should primarily be regarded as experts who enable the development of academic insights by scientific discourse.

To make this work, a new approach of mentorship has been introduced together with the new curriculum. Each student becomes a member of a mentor group that is chaired by a staff member of the faculty. A mentor group consists of about 12 students from all three years of the Bachelor program, about four students from each generation. The mentor groups provide a social structure in which the master (the mentor/staff member) and the experienced students from the second and third year help the first year students (the learners) to be initiated in the professional culture of academic professionals. In these groups the discussion of personal development towards becoming a competent professional is a standing issue. The group members are required to collect evidence of professional growth that lends itself for discussion with the mentor and in the mentor groups.

The students collect the evidence of their professional development in their electronic portfolios. Each portfolio consists of four parts: (a) An introduction of the owner (student), (b) a text based curriculum vitae, where the student is expected to put personal information, information about his or her school career, information concerning professional development in or outside of the official program (like having a job in the field) and other information such as involvement in sports and hobbies; (c) an archive, where the student puts evidence of his or her professional development during the study; and (d) a showcase where the student chooses to present a selection of his or her best work. The archive is the central tool for the student to perform self-assessments about specific accomplishments as well as to reflect on personal development in general. Self-assessment is considered to be a form of metacognition that is essential for self-regulation (Simon & Forgette-Giroux, 2000).

Additional features of the new curriculum are that the development of information and communication skills is integrated into courses and that all courses are organized using a Web-based course management system (TeleTOP, a home-made Lotus Domino application).

The implementation of the new approach requires a substantial change of teacher behavior. Most teachers are used to teacher-controlled instructional formats. Some teachers, however, share the philosophy of the new curriculum concept. They should act as the pioneers and early adopters who provide a critical mass of authentic professional tasks that allow student to develop the necessary skills for self-regulation of their academic education. These tasks and the interaction in the mentor groups are expected to shape the attitude and abilities of the student into characteristics of self-reliant young professionals. The extent to which this will appear to be true will answer the first research question.

Approaching the students in such a way that they perceive the need to adopt a professional attitude is expected to cause students to work conscientiously on compiling evidence of their professional development in the form of portfolio products. They then will seek feedback of the teachers on their work and ask for comments on the added value of assignments for the objectives of a course and in the framework of the competency profile of the Bachelor program as a whole. It is expected that this behavior will influence the teaching style of the academic staff and will help teachers who are reluctant to invest in the new educational concept to move in the desired direction. The extent to which this effect occurs, will answer the second research question.

The first experiences

Preparing for the academic year 1999-2000

The principles of the new approach have been presented to the teaching staff on several occasions, at first to estimate whether the concept was appealing to them. The overall impression was sufficiently positive to start the preparation of the introduction of the new approach in the program. A few months before the academic year 1999-2000, a group of student-friendly staff members was invited as mentors. Together with the faculty management they developed procedures and a related manual to start the new mentor groups. Involving the mentors at this stage resulted in their ownership of the concept for the new mentor groups and the way of working in those groups. Elements of the approach are that competency development was related to three major roles of professionals in our field: designer, researcher, and consultant; and that explicit attention should be paid to generic competencies such as planning, self management, interpersonal skills, communication, and academic reflection. In respect to the individual development of the students, a list of products that should be collected in the portfolios was specified. They concern results from assignments in courses that may be considered as evidence of acquired knowledge and skills, thus contributing to the competency profile of the student. Monthly professional meetings of the mentor groups were planned to discuss progress. During these meetings also attention was paid to the quality of the program as experienced by the students. It was expected that the students in their role as beginning educational designer should be interested in strengths and weaknesses of the courses in which they participate. The input from the mentor groups was also considered as valuable for the formal evaluation of running courses. The teaching staff was informed about the intended approach and invited to work accordingly.

Outside the mentor groups, information and communication specialists developed their curricula in close cooperation with teachers from selected courses to arrive at the integration of relevant tasks and assignments in the different courses.

Results from the academic year 1999-2000

The mentor groups appeared to be handicapped by the fact that it was the first year and thus only first-year students were members. The monthly meetings failed also because the students had such a close contact with each other throughout the week, that no substance to discuss remained for the meetings. Course evaluations became a formal ritual with no real impact.

Teachers and students appeared to behave more traditional than expected, leading to much interaction in an instructional context and little in a professional context. The instructivistic teaching style in many courses appeared a dominant factor in shaping student behavior. Instead of working on a professional attitude that complies with the model of the students as young colleagues, the students felt that they went to school to take lessons and make tests.

Moreover, due to technical problems portfolio software was introduced to the students at a late stage (the end of the first semester). Students had then to go back to already completed courses to find the required products for their portfolios. It was unlucky that for unclear reasons they appeared not to be informed about the list of required products that existed from the beginning of the academic year. And when they learned about the list, several students became annoyed because they consider that list as contradictory to the concept. If the portfolios are tools for governing one's own learning process, they should be able to decide by themselves what to put into it. At that time, so much was unclear, that most students failed to work with the portfolios in a proper way. In conclusion, the electronic portfolios were hardly used.

The only thing that really worked was the integration of information and communication skills into courses. The carefully developed set of tasks on information and communication skills made the students acquire the related skills every time they needed them for the assignments in the courses. A literature assignment in a course on pedagogy was used to teach them how to find literature, an assignment to write a paper for an other course was used to explicitly pay attention to writing skills, and so on.

2000-2001: Some changes

The insight was developed that students should not be forced to put products in a portfolio, because this is contradictory to self-management. The students, who were interested in the desired approach, told that to us more than once and they were right at this point. The mentors were asked to guide the students in developing self-management skills, using the electronic portfolio as a discussion platform.

Now that students of two study years were member of the mentor groups, activities were specified that could bring the concept to life. The elderly students could now introduce the new students to all kinds of procedures and habits in the faculty. And group discussion could now aim at points of interest for which the vision of both the first year and the second-year students was relevant. The number of official meetings, however, was reduced to seven. This measure was taken to avoid the problem of too few subjects for discussion that came with the monthly meetings in the first year.

Changing the teaching style of teachers towards competence development seemed not to be possible directly. So a major role for the mentor was envisioned given the character of the guild model in the mentor groups. The mentors were asked to work with the students on helping them to use their portfolios for self-governance.

Results from the academic year 2000-2001

This time the mentors started to resist to the idea that they should work with the students in such a way that the students would develop the metacognitive skills to monitor their own professional growth with the electronic portfolio's as the basic tool. They argued that the curriculum and the way in which the courses are taught, should have this effect.

Again, the portfolios were hardly used although the software was now available almost from the beginning. But the early start had also a disadvantage. The students were introduced to the portfolio software in a workshop where to technical skills were practiced without real products to put into the portfolio. The first products that would be suitable had still to be produced in the courses that just were started. By the time that the portfolios could be used, most students had forgotten how to do that. As there was this time no list of required products, only few students appeared to motivated to start filling their portfolios. Many other students, however, appeared not to be able to decide what they could put into the portfolio. Partly the reason is that they appeared to be very critical of their first-year products, considering their own work as real beginners work that is not worth to be put into a portfolio.

The cooperation between students from different years appeared to be one-sided. Only in the beginning of the academic year were the older students active when introducing the new students. Subjects of mutual interest to old and new students were not identified. The new students could also not bring anything of relevance for the older student. The question: " What are my benefits?" was hard to answer for the older students.

Still, the students were positive about the meetings of the mentor groups. During the meetings the students discussed general information with their mentor and with each other and they used the meetings as a platform to complain about organizational or educational problems in the faculty. They could speak freely about anything, which gave the meetings an "I am not alone with this" function.

Putting students in control

2001-2002: A last chance for portfolio's?

Gradually it becomes clear that the basic philosophy of the concept "Initiation in the Academic Profession" does not really settle in the faculty. The belief that the concept is worthwhile is reason for a third attempt. This is where the approach was developed that is the reason for this paper. Again the idea is that the students should develop initiative in using their portfolios as a tool for collecting evidence of their professional growth. In the first week of the academic year, they were trained to use their portfolio's in two ways: technically to learn how to put elements in the portfolio and how the manage the portfolio; and conceptually on how to use the portfolio for monitoring and managing professional progress. An adapted guide for the mentor groups explained the purpose and the philosophy: It was recognized that not all students are ready for this kind of metacognitive activity. They are therefore allowed to use or not use their portfolios for self-management. Filling the archive with products of courses, however, is this time required to maintain basic portfolio skills until the moment that the student is ready and willing for the intended use.

The results so far

The number of students that works with the portfolios in the intended way is negligible. There are just a few students who work with their portfolios. These students are mostly using the archive function just for their own purposes and not to reflect on what they have done in past periods. Also most mentors still don't use the portfolios for the individual meetings with the student. Some of them do, but they leave no room for self-directedness by the students because they *require* the students to fill the archive.

In the meantime, the discussion about the usefulness of portfolios has become an issue in a broader perspective. Students who are following the old curriculum (from before the introduction of the new educational concept) start asking for their own portfolio's for making overviews of products that they collect in courses during their study. So these oldest students see the purpose and the advantages of portfolios from a need for systematically archiving products. Regrettably, however, when providing them with the portfolio software, they don't find the time to really do it. It seems a similar phenomenon as with the staff members who like the idea of the new educational concept, but do not really change their methods to comply with it.

When student and staff members are asked what they think about the portfolio idea, they are almost all very positive. But still, it did not work out. The project fails and we have to find out what we may learn from it.

Discussion

Why portfolio's can be a success

When looking for a field where portfolios do work, the field of Human Recourse Development (HRD) is an obvious one. Self-responsible adults, who have a job and related responsibilities, benefit from individual learning arrangements that are reported by collecting evidence of achievements in a portfolio. The use of (electronic) portfolios is in that context appropriate because the learner has sufficient metacognitive (and computer) skills to use the portfolio tool properly. The educating agency (training department, external course provider, etc.) shares the philosophy of competency-based education and is therefore open to assessment on the basis of individual portfolios. This context is essentially different from the university situation where young students who enter the university directly from secondary school, do not have the maturity, the experience and the interest to work along these lines. This is the starting point for discussing why portfolios may fail.

Why portfolio's fail

Portfolio's fail when the students don't see the value. Portfolio proponents tend to deny the psychological developmental stage of the students. But many (young) students are not prepared or willing to look at themselves in the metacognitive way that is required for proper dealing with portfolios. Further it seems that the spontaneous fun in studying theory is hampered by precise questions about the requirements that have to be fulfilled for a competency-based curriculum. A student, who is really involved in a subject, has to make a severe mental switch when he or she has to step outside that subject to analyze on a metacognitive level whether what he or she is doing is a contribution to the development of competence.

And even when students see some value, for instance for building a comprehensive archive of their work during their study, they may misinterpret the function of the archive by denying products of which they are not very proud, like the first-year products when they feel themselves still beginners. To reflect on professional growth, however, these products are needed for reasons of comparison with later accomplishments. Proper guidance of the students by mentors could help, but this requires that the mentors are convinced of the value of portfolios as a tool for monitoring progress. In our case, we were clearly not able to motivate the mentors in this sense.

And there is also a very practical reason why portfolios may fail. That is when the software causes problems. The system may need to many steps for simple tasks, the server may too often be too busy, and so on. In our case, several technical limitations did for certain not stimulate the use of the portfolios.

Portfolios also fail when the teachers fail to adjust their teaching accordingly. Teachers are mainly prepared to carry out a well-defined course. When they have to step beyond the concrete patterns to adjust themselves to individual trajectories, many teachers fail to comply with that fact. The idea that a concept such as "initiation in the academic profession" can be put into practice outside the courses by regarding the traditional courses as occasions for gathering portfolio products that are used by the students and mentors, does not work. The concept and the use of the portfolios have to be operationalized within the courses.

Where to go from here?

Who wants to succeed in an effective learning process, ought to be able to coordinate his own learning process (McCombs, 1988). In order to make the concept "initiation in the academic profession" successful, we will have to arrange a situation in which the students will be helped to get ready to do so. And this has primarily to happen in courses, while the new mentor groups may have a support function. The developmental readiness of the students has to be taken into account. Alexander (1995), for example, mentions three stages for the evolution for the learner. In the habituated stage, the student has a diminutive knowledge level. Having just a little domain-specific knowledge the student appeals on common strategies. The second stage is the ability or competency level. The students get more comprehensive and coherent knowledge of the subject and there is a change the student will select the correct strategy for the specific situation. The third stage is the expert level. At this stage the students have ample knowledge of domain specifics, are ready to regulate themselves, and are able to add new knowledge to the domain. These stages ask for a curriculum line in which each stage has a logical place. This leads in our case to a choice for courses in which the three stages have a natural place: the series of courses about design methodology that runs form the first to the third year. This choice is inspired by the Design Studio as it works at the Master's level at the University of Georgia at Athens (Rieber, 2001). The principle as it will be tried in our program is that third-year students will take responsibility for design assignments while second-year students will act as helpers for specific tasks that need already proper workmanship (like carrying out a literature study or an evaluation), and first year students will be used for very concrete tasks for which it is not necessary to be very knowledgeable about the specific domain. In this stream, the principles of the concept "initiation in the academic profession" may be fully exploited, together with the use of portfolios. Next to and in balance with this stream, theory courses may still be taught in more traditional ways as long as all teaching complies with the seven principles for good practice in undergraduate education as listed by Chickering en Gamson (1987, quoted by Chickering en Ehermann, http://www.aahe.org/technology/ehrmann.htm): (a) good practice encourages contacts between students and faculty, (b) good practice develops reciprocity and cooperation among students, (c) good practice uses active learning techniques, (d) good practice gives prompt feedback, (e) good practice emphasizes time on task, (f) good practice communicates high expectations, and (g) good practice respects diverse talents and ways of learning.

After the lessons learned with our attempts to introduce electronic portfolio's faculty wide, we hope that the more modest approach for introducing portfolio's and competency-based learning in the design stream of our program, will appear to be the right step to help to initiate our students into the academic profession.

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Video Outside Versus Video Inside the Web: Do Media Setting and Image Size Have an Impact On the Emotion-Evoking Potential of Video?

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Abstract

To explore the educational potential of video-evoked affective responses in a Web-based environment, the question was raised whether video in a Web-based environment is experienced differently from video in a traditional context. An experiment was conducted that studied the affect-evoking power of video segments in a window on a computer screen compared to presenting the same video materials on a television monitor. The study first demonstrates that affect-evoking power of video exists. Although not always significant, the results show that selected positive and negative video clips induce positive or negative affective responses and mood changes in participants, in a Web-environment as well as in a television environment. Smaller window sizes, however, may do less well.

Introduction

Technical developments make it continually easier to use streaming as well as downloadable video in Web-based applications. This raises growing interest in the use of video segments within Web-based multimedia learning environments (see for example Collis & Peters, 2000). Video has the potential to present dynamic content. In the cognitive domain moving images with sound and accompanying voice-overs may, for instance, provide insight in technical processes and procedures. In the affective domain video materials may evoke affective responses in the learner that relate to the instructional content of interest. A well-known example is the use of trigger video's that present emotional demanding situations as input for learning experiences. These examples represent two characteristic functions of video: (a) the potential to facilitate the acquisition of knowledge and skills, and (b) the use of video to bring material into the learning environment for affective learning goals. The present study relates to this second function of video.

Affective video materials can show realistic situations and people depicted directly from reality or dramatised in story lines. Footage from real situations as well as dramatised story lines make it possible for viewers to identify themselves with persons on the screen and to become involved in the situations that those persons meet. For educational purposes this potential of video is used to evoke emotions and to stimulate discussion. Topics to be discussed may vary from historical and societal to ethical issues. Not only the content of the video is important for evoking affective responses, but there is also a contribution from production variables such as music, editing, camera handling and lighting (resulting in a "video structure"). Video content and video structure are not independent but interacting variables. Video-production techniques and their influence on the way video content is experienced are discussed in for example Wetzel, Ratke and Stern (1994) who approach video design from a research perspective, and Millerson (1999) and Zettl (1999) who draw upon the trade of film and video makers. The potential of video to evoke emotions and the relationship between video structure and video content is also a topic in communication research (for example: Geiger and Reeves, 1991; Lang, Dhillon, & Dong, 1995; Lang, NewHagen & Reeves, 1996).

Affective video materials may further have educational potential when combined with specific (creative) tasks that follow a segment. Research studies by Isen (for example Isen, Daubman, & Nowicki, 1987) and Kaufmann and Vosburg (for example Kaufmann and Vosburg, 1997, Study 2) show that video segments used to evoke emotions can influence the performance on a task that follows the video segment. The content of the video segments that they used was not related to the task, but served merely to induce an affective response or mood in the subjects. Their work shows, however, that video may be considered as an effective emotion-evoking or "mood-induction-technique", a finding which is confirmed in a review by Gerrards-Hesse, Spies, and Hesse (1994).

The tasks involved in the research of Isen and Kaufmann and Vosburg are (creative) problem-solving tasks, varying from categorization, association, developing insight, to divergent thinking tasks. Positive and negative mood states seem to be related to the way a problem-solving task is carried out. Their results suggests that a positive-affect video could be more effective for a certain type of task and a negative-affect video for another type of task. For a recent model about the influence of mood on problem solving, see for example Vosburg and Kaufmann (1999).

Affective video materials implemented in a Web-based learning environment are expected to be potentially similarly effective for reaching specific pre-defined affective goals and for having a mood-inducing function that stimulates the solving of specific problems. As an additional effect affective video might also contribute a sense of "warmth" to a technological system like a Web-based environment which may help to maintain interest in the learning task.

This study is a step in exploring these expectations by first trying to confirm that video has indeed the potential of evoking affective responses and mood changes in subjects in a traditional setting for watching television. Subsequently we will examine whether video materials presented in a Web-like environment have a similar effect.

Video materials in a Web-based learning environment are presented in a video window that is smaller than video shown on a television screen. Therefore a second question is raised whether image size is a relevant design factor that influences the affective potential of video materials in a Web-environment. Research on image size of emotion-evoking movie fragments shows that screen size does indeed have an effect on how the movie is experienced. Little screens are less liked, produce less arousal and the content is remembered less compared to big screens (Reeves & Nass, 1996; Reeves, Lang, Kim & Tatar, 1999). Video materials presented in a little video window within a Web-environment may thus have less affective potential than the same videos presented in a bigger video window.

From an instructors point of view, who may be considering a shift from traditional classroom-use of video to using video within a Web-environment, it may be relevant to know whether differences exist between the two types of media settings (watching television vs. watching video in a window on a computer screen). This will be the third question of our research.

In summary, the following three research questions are stated to explore the affective potential of video materials in a Web-based environment:

1. Are video materials that are selected for their potential to evoke either positive or negative affective responses and mood changes in participants, effective when the video is presented:
   a)within a traditional television-viewing setting (group or individual setting), or
   b)within a Web-like environment (individual setting).

If this is the case:

2. Does image size have an effect on the magnitude of affective responses and mood changes in participants (within Web setting; within television setting).
3. Does the media setting have an effect on the magnitude of affective responses and mood changes in participants (between television and Web)?

Method

To study these questions, an experiment was carried out that is specified below.

Participants

The participants for the experiment were 117 first-year university students in communication studies (82 women and 35 men, mean age = 18.5 years). The experiment was part of a course that introduces the field of media communication and media research and was introduced as an introduction to doing experiments. The results of the experiment and the experience of the students in participating in the experiment were discussed in class a month after the experiment.

Materials

For the selection of affect-evoking video materials, video segments of about two or three minutes were used from existing films or television programs. In a pilot study situated in a traditional classroom setting, six video clips were tested with students for the affective responses they evoked. Some of the clips showed positive content (content that is expected to evoke positive feelings), other clips showed negative content. The pilot showed that two of the positive video clips and two of the negative video clips were effective. For both affect types the briefest clips where selected for the experiment. Selecting the short clips seems justified by the fact that Web users are used to brief presentations. The shorter clips are thus more realistic to embed in a Web-environment than longer clips (5 minutes or longer). In the experimental setting the positive video content consisted of a segment from the comedy movie 'When Harry met Sally' (2'45"); the negative video content was a news-item about 'Hunger in Ethiopia' (2'04"). Half of the subjects were shown first the negative content and then the positive content. For the other half this was the other way around. To 'buffer' the impact from one type of affective content to the other a video segment was presented in-between (a segment from an instruction video on welding, 2'27"). To establish a comparable starting position for all subjects a video segment was added as a first video clip for all participants. This segment was a part of a documentary about birds ('1'53").

Design and procedure

An experimental factorial pretest-posttest design with three factors was chosen. Factor one is the 'affective content of the video' (positive versus negative). Factor two represents the 'playback size of the video' (little versus big; the bigger size is linear two times the smaller size, resulting in an image area that is four times the smaller size). Factor three is 'media type' (television monitor versus computer monitor). All three factors were studied with settings for individual participants. In addition to the individual settings a group setting was introduced as an extra factor to explore social effects that may influence the magnitude of affective responses to video.

Subjects were randomly assigned to one media type setting and within this setting to one video playback size. A matching procedure was used for the variable male/female. Subjects received in advance information about the location of the experiment and the allocated time for it. At the entrance of the experimental room the subjects were given a number to a specific 'seat' in the room. For each seat the presentation order of the positive and negative video segment was predetermined. The two versions were:

Version 1: clip2=positive and clip4=negative, and
Version 2: clip2=negative and clip 4 = positive.

All subjects encountered both positive and negative video contents. Table 1 shows the order of clips in all settings.

Table 1. Overview of the experimental conditions

	INDIVIDUAL TELEVISION SETTING	INDIVIDUAL COMPUTER SETTING
Small	Small television monitor (14", S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	Small video window (320*240 pixels, screen resolution: 1024*768) docu – pos – instr – neg docu – neg – instr – pos
Big	Big television monitor (28", S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	Large video window (640*480 pixels, screen resolution: 1024*768) docu – pos – instr – neg docu – neg – instr – pos
	SOCIAL TELEVISION SETTING	
Big	Big television monitor (28", S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	

Note:

docu = segment from a documentary about birds
instr = segment from an instruction video about welding
pos = segment from 'When Harry met Sally'
neg = segment from a news-item about 'Hunger in Ethiopia'

The experiment was conducted in four rooms:

- Room 1: Big television-monitor setting;
- Room 2: Little television-monitor setting.
- Room 3: Computer setting (for all computer conditions for small and large video windows);
- Room 4: Big television monitor in a social setting.

The individual arrangements were in such a way that the viewing angles for the television and the computer conditions were the same: Watching the big television monitor took place with the same viewing angle as watching the large video window on the computer screen; watching the small television monitor took place with the same viewing angle as watching the small video window on the computer screen. To accomplish this, viewing distances were carefully controlled.

Four experiment monitors and four assistants were hired and instructed. In advance students of the course were informed about the research group (time, and location) to which they were assigned. They were asked to gather in a central location in the building, so that no current sessions would be disturbed. Each experiment monitor for a certain condition (room) invited his/her group to go to the room. The assistants waited for the participants at the room. Upon entering the room, the assistants gave each participant their seat number (see above). They were asked to read the information about the experiment, fill in their name and wait silently for the experiment monitors to start the experiment. They also had to sign an attendance list for the course administration. A few days before and at the day of the experiment some students attended that were not in the register that was used for the assignment procedure. Because of the course credits they were allowed to participate and assigned to the different settings.

The experiment monitors gave a brief introduction to the experiment. The procedure and the instruments (questionnaires) where automated into a (web-like) computer-based environment. For the computer setting this was done to create the look and feel of a Web-environment. To be consistent in the overall procedure the individual television-monitor settings also used this environment for filling in the digital questionnaires. Thus in both settings the same procedures were used. In the social television-monitor setting printouts of the instructions and questionnaires were used.

In the computer setting the video clips were announced and shown within this setting. The video clips were shown as part of a separate almost full-screen window to provide a neutral (dark grey) background and was followed by a questionnaire. In the television-monitor setting the participants used the computer for filling in questionnaires and switched to watching a television monitor when a video clip had to be started. In this condition the video clips were available on tape in a video player. The videotape contained all four video clips. Each video clip was preceded by 10 seconds of black screen and the clip's title (like

"Video clip 1") to assure enough time for the VCR to start playing and as confirmation for the participants that the correct clip was started. After each clip a message to stop the tape was presented.

Scoring

Instruments. A questionnaire containing bipolar affect and mood items using a 7-point Likert scale for response was used to assess the affect-evoking and mood change potential of the positive and negative video materials. Non-relevant items about cognitive responses (evaluations of the videos) and arousal items were included to make the aim of the experiment less obvious to the participants. A questionnaire consisted of three sections: A section with questions about the mood state of the participants (including also arousal items), a section about the feelings evoked by the video clip (affective responses) and a section with questions about the opinions (evaluations) about the video clip. As mentioned in the design and procedure section the instruments (questionnaires) where automated into a (web-like) computer based environment and presented after viewing a video clip. To prevent that participants would develop a repetitious way of filling out the questionnaires, the order of the sections in each questionnaire was varied and also the direction of the items. Since the second and the fourth video clip were the actual affective video clips of interest in the experiment, the section of the questionnaire that measured the mood state was always placed in such a way that a pretest – posttest measurement of these clips could be made. The last section of the questionnaire belonging to the first video clip was the mood section, because this was meant to be the pre-test measure for the second clip. The first section after viewing the second clip was again the mood section as a post-test measure. For the fourth clip the same strategy was used.

The final Mood scale consisted of three items, the final Affect scale consisted of five items (Figure 1).

Mood scale: three items:			Affect scale: five items:		
Very negative (1)	-	Very positive (7)	Very negative (1)	-	Very positive (7)
Very unpleasant (1)	-	Very pleasant (7)	Very unpleasant (1)	-	Very pleasant (7)
Very somber (1)	-	Very cheerful (7)	Very somber (1)	-	Very cheerful (7)
			Very sad (1)	-	Not at all sad (7)
			Very happy (1)	-	Not at all happy (7)

Figure 1. Rating scales for mood and feeling

A reliability analysis of the mood items showed that the three items together produced a mood scale with an average Cronbach's alpha score of .88. Originally there were six feeling items. They produced a reliability score of .85. When one of the feeling items (very involved / not at all involved) was deleted, the alpha score increased and resulted in an average score of .90. (See Table 2). The reliability scores for the Mood scale and the Affect scale are thus quite acceptable.

Table 2. Cronbach's alpha scores for the final mood and feeling scale

	Mood Scale (3 items)	Affect Scale (5 items)
Questionnaire 1 (clip1)	.7758	.8487
Questionnaire 2 (clip2)	.9358	.9811
Questionnaire 3 (clip3)	.8452	.8007
Questionnaire 4 (clip4)	.9557	.9842
Mean questionnaires	.8781	.9037

Results

Homogeneous treatment groups

The first video clip and accompanying questionnaire served as a pre-test measure for all treatment groups. An analysis of variance (one way anova) showed no significant differences between the groups on the Mood scale and the Affect scale (Mood scale $F[9,116]=1.048$, $p=.407$ and Affect scale $F[9,116]=.606$, $p=.790$). The treatment groups can be considered homogeneous on the dependent variables.

Group sizes and gender. The average group size was n=12 (11.7). On the average 29.9% of the participants were male and 71.1% were female. Data showed, however, that two treatment groups were different from the other groups. The treatment group "computer / small video / version 2 (clip2=neg, clip4=pos)" appeared to have a relatively small number of participants (n=6). For the treatment group "television / small video / version 2 (clip2=neg, clip4=pos; n=9)" atypical male/female proportions were observed of 66.7% en 33.3% respectively.

Affective responses and Mood changes

Within television settings. First we wanted to confirm whether positive and negative video materials could evoke affective responses and mood changes in participants within a traditional television viewing setting (both social and individual). A paired-T-test was conducted for the settings with television. In this analysis the first clip (documentary) was compared with the second clip (being positive in version 1 and negative in version 2).

For the positive clip significant effects were found in all television settings for a change in evoked affective responses. Only in the individual small television setting no significant mood changes for the positive clip were found (p=.358).

The negative video clip produced in all television settings significant effects for a change in mood state and in evoked affective responses.

Within Web settings. For the positive clip significant effects for mood change and feeling change were found in the Web setting with the large video in both versions. For the small video's no significant effects were found on mood changes (p=.119) and changes in affective responses (p=.078). The negative video clip produced in all television settings significant effects for a change in mood state and in evoked affective responses.

Comparisons of image-size within a media-setting

Procedure. As the data showed that two treatments groups of version 2 appeared to have a relatively small number of participants or an atypical male/female proportion, the analyses of the results will be based on version 1. In that version the sequence of the clips was clip 2 = positive and clip 4 is negative. For the exploration of image-size effects version 1 is taken as starting point for within-media-type comparisons. Clip 1 (documentary) had a slightly positive score for mood and affect and Clip 3 (instruction) had a slightly negative score on mood and affect. Both are, however, sufficiently close to the middle of the scale to be regarded as "neutral clips".

Both for the Mood scale and the Affect scale only change scores are presented (not the absolute scores). Change scores are more informative because they represent the pretest-posttest differences in the line of the intentions of the experiment.

Within TV-setting: Big versus little TV. For the big tv-monitor setting (n=11) and the little tv-setting (n=15) the mean change scores for mood state and affective responses were compared. With one small exception the bigger video seemed to have more impact than the smaller video both for the positive video (clip 2) and the negative video (clip 4), see Table 3 and Figure 2 and 3 (third and fourth treatment setting). A T-test (for two independent samples) showed a significant effect on mood change for the positive clip (clip 2) with $T(24,26)=2.156$, $p=0.041$ (two-tailed).

Table 3. Video setting: Sample sizes, Means, Standard Deviations and Standard Errors for Mood and Affect Change Scores by treatment

Change scores	Treatment	n	Mean	St. Deviation	Std. Error Mean
Mood change clip2	tv/big video	11	3.55	1.44	.43
	tv/small video	15	.93	3.81	.98
Mood change clip3	tv/big video	11	-5.82	3.68	1.11
	tv/small video	15	-3.07	4.67	1.21
Mood change clip4	tv/big video	11	-2.00	2.10	.63
	tv/small video	15	-2.60	3.04	.79
Affect change clip 2	tv/big video	11	7.27	5.39	1.62
	tv/small video	15	6.40	9.04	2.33
Affect change clip3	tv/big video	11	-13.27	4.86	1.47
	tv/small video	15	-9.73	8.19	2.11
Affect change clip4	tv/big video	11	-8.82	3.82	1.15
	tv/small video	15	-6.73	3.99	1.03

Note:
Statistics for Version 1 of Clip sequence: Clip2=positive; Clip3=instruction; Clip4=negative

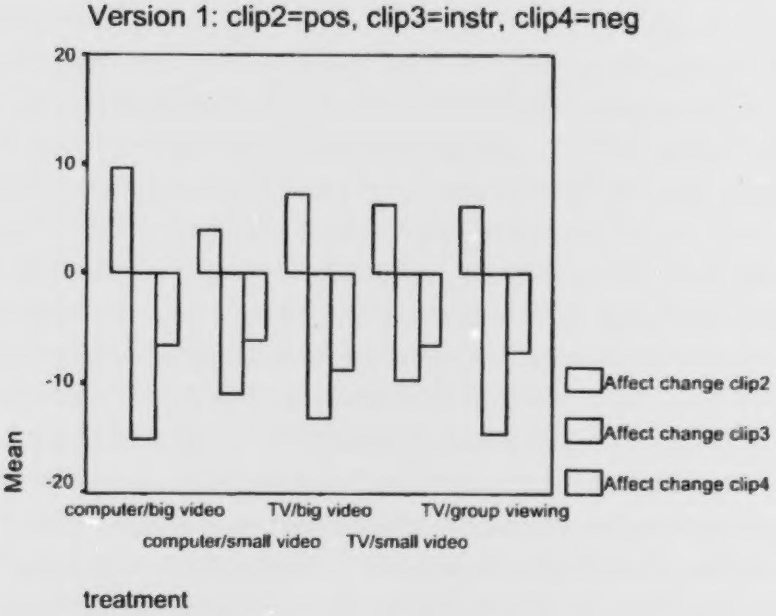

Figure 2: Bar Graph of Mean Change Scores for Mood (Version 1 sequence of video clips)

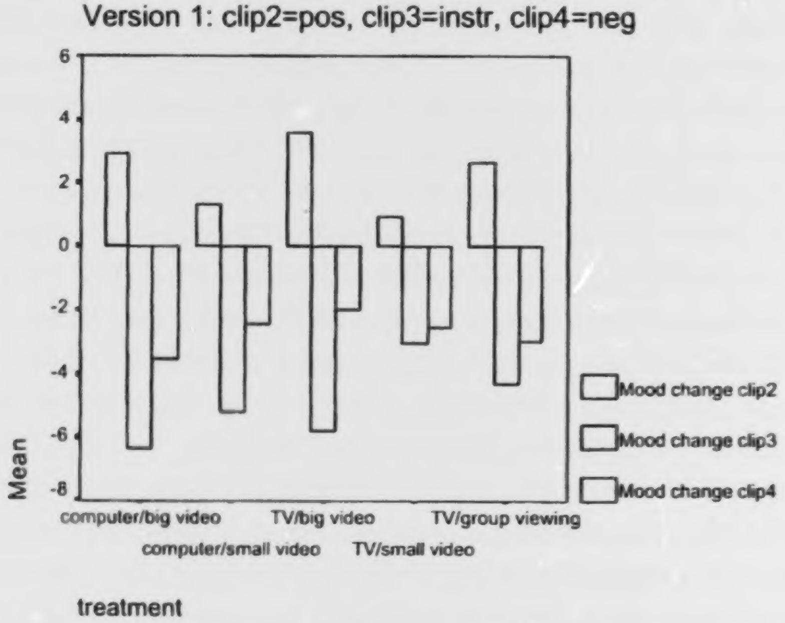

Figure 3: Bar Graph of Mean Change Scores for Affect (Version 1 sequence of video clips)

Within Web-setting: Big versus little video play-back size. In the Web-setting the bigger video play back size (n=14) and the smaller play back size (n=13) were compared. Without exception the bigger playback size always produced a larger mean score for mood change and affect change than the smaller video size as is shown in Table 4 and Figure 2 and 3 (first and second treatment setting). A T-test (for two independent samples), however, showed that these differences were not significant. When we look at the female participants only within the Web-setting (n=9 for both image sizes), we did found significant differences for image size for affect change by the second clip, the positive clip (p=.033, two-tailed) and for the third clip, the slightly negative clip (p=.029, two-tailed).

Table 4. Web setting: Sample sizes, Means, Standard Deviations and Standard Errors for Mood and Affect Change Scores by treatment

Change scores	Treatment	n	Mean	Std. Deviation	Std. Error Mean
Mood change clip2	computer/big video	14	2.93	4.01	1.07
	computer/small video	13	1.31	2.81	.78
Mood change clip3	computer/big video	14	-6.36	5.00	1.34
	computer/small video	13	-5.23	4.21	1.17
Mood change clip4	computer/big video	14	-3.57	3.48	.93
	computer/small video	13	-2.46	2.50	.69
Affect change clip2	computer/big video	14	9.57	7.78	2.08
	computer/small video	13	3.92	7.33	2.03
Affect change clip3	computer/big video	14	-15.21	5.99	1.60
	computer/small video	13	-11.00	5.82	1.61
Affect change clip4	computer/big video	14	-6.64	6.27	1.68
	computer/small video	13	-6.15	2.94	.82

Note:
Statistics for Version 1 of Clip sequence: Clip2=positive; Clip3=instruction; Clip4=negative

Comparisons of media-settings: Web versus television

Although comparisons between media types are difficult to make, because different media and viewing context variables are at stake, we wanted to explore whether media setting (media type plus viewing context) might have effect on the magnitude of affective responses and mood changes. This could be a relevant question for instructors in their media selection process. Therefore the Web-settings and the television settings were compared. First the smaller image sizes and then the larger image sizes in both settings were compared. As mentioned in section 'Design and procedure', we controlled for viewing angle to exclude differences between the settings on this variable. T-Test showed that no significant differences between the media settings were found. A comparison of the small video-playback size in the Web setting (n=9) with a big television monitor applied in a classroom-like presentation (n=10) showed no significant effects. When however the big video playback size (n=14) within the Web-setting was compared with the small television setting (n=15) a significant effect was found. In this case the Web-setting produced more impact on mood state and affective responses than the television setting (p=.049, two-tailed).

Discussion

One of the most powerful characteristics of video media is their potential to evoke emotions. This is one of the reasons why video material is often selected for educational purposes. This study raised the question whether affective video in a WEB-based environment is experienced differently from video in a traditional context and whether video image size is a relevant factor to consider in this context. The key question is in short: "Affective video in a Web: Does it work ?".

We started this paper with the expectations that affective video materials might indeed work when implemented in a Web-based learning environment. Media-setting (Computer[Web] versus television), affective video content (positive versus negative) and image size (big versus small) were the three key factors in the experiment. Another factor, social versus individual viewing situation, was introduced to see whether this is a relevant aspect of the media-setting to consider. For an overview of the treatment groups we refer to Table 1.

The results show that we found evidence for the affective potential of video for both media settings. Only in the individual television setting with the small monitor this effect was not significant on mood changes for the positive video clip as second clip. Also in the Web-environment we found that the affective video materials were effective in evoking affective responses and changes in mood. Again the small positive clip as second clip was the exception to this rule. The reason why the positive clip as second clip did less well in the small image settings, might have to do with the character of the first clip. This clip (documentary about birds) was also experienced as (slightly) positive, which reduced the room for further positive change of mood or affect. The fact that in some cases the smaller video's didn't work, made the question about image size even more relevant. In general, however, we can conclude that affective video materials can be effective when embedded in a Web-based environment.

As far as image size is concerned, in almost all treatment groups the larger image size seemed to have more impact than the smaller video for both affective clips. This 'pattern', however, was only significant for mood change for the positive clip (clip 2) in the television setting. When we looked at the female participants within the Web-setting we did found significant differences (although two tailed) for image size on affect change by the affective video clips (including the third clip). With the relatively small sample sizes (on average n=12) in this study it is, however, not easy to find significant differences between the treatment groups. We suggest for further studies the use of larger sample sizes, controlling for gender, and a broader range of affective clips to explore the image-size issue more in depth. It is, for instance, unknown whether the impact of mood or affect change on performance is subject to threshold levels. Small differences in the amount of change could then be critical, which may add importance to findings such as in this study.

Not only may image size have an impact on affective responses and mood changes, but also on arousal (another aspect of emotion) and attention. A study by Reeves, Lang, Kim and Tatar (1999) about the effects of screen size and message content showed that image size can increase attention and arousal for audio-visual messages. Arousing pictures, like sex and violence for example, produced higher levels of arousal when presented on a large screen than presented on a medium or small screen (screen sizes were respectively 56 inch, 13-inch and 2 inch picture heights). Also larger images were remembered better the smaller images. It would be interesting to explore these issues within a Web-environmental context, also to find out whether Reeves, Lang, Kim and Tatar are right when they state that "The inclusion of display size as an important variable in media research seems critical (p. 64)."

One of our purposes was to explore from an instructors point of view whether a shift from traditional classroom or individual use of video to an individual Web-based learning environment would have an impact on the way in which the same affective video materials are experienced by students. A comparison between the two media-settings in this study (television versus Web) was made. No significant effects were found with one exception: The large videos within a Web-environment evoke stronger affective responses and mood changes than the small television monitor. This might be the case because the image size was perhaps experienced as relatively big because of the short viewing distance to the monitor in the computer setting.

This study could not reveal effects for viewing affective video materials in a group. This was expected, but the actual experimental setting was probably too atypical for a social viewing session because of the procedure and the questionnaires. The session was primarily experienced as a laboratory setting. Laughs or other sounds made aloud were rare. In future research a more realistic viewing situation should be created.

For the measurement of the affective responses and mood states we used Likert-scales for response. A disadvantage of this type of measurement is that it is subjective and that it asks for insight in one's feelings and mood. We would recommend the use of more objective instruments like physical measurement techniques, if available, to contribute to the validity of this type of research.

In conclusion. When we return to the question: "Affective video in a Web: Does it work ?", the answer is that in most cases it does, but with smaller window sizes it might do less well. Which leads for the time being to a general advice for applying videos in the affective domain: Try not to compromise on image size when shooting or selecting affective video materials for the Web.

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A Cognitive Map of Human Performance Technology: A Study of Domain Expertise

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Abstract

Using the Pathfinder Scaling Algorithm (Pathfinder) (Interlink, 1994), the researchers conducted a cognitive task analysis expertise in Human Performance Technology (HPT). The study investigated: 1) the extent to which Pathfinder-derived coherence scores were associated with other measures of HPT expertise; 2) how HPT experts organize their knowledge of the discipline; and 3) how experts organize their HPT knowledge differently than novices. Findings include: 1) a significant correlation between coherence and the number of HPT-related books participants had written; 2) a Pathfinder-derived concept map of HPT; and 3) expected novice/expert differences in Pathfinder similarity and relatedness scores.

Most representations of academic disciplines have been created when experts depict or report what they know. Experts draw diagrams, establish competencies, and write textbooks. Clearly, this approach works; new practitioners use these representations to enter and gain competency in the discipline. Some practitioners eventually master elements of the discipline. However, there are potential problems that can arise when practitioners rely on expert self-report. Simply stated, experts are often unable to state what they know and do that makes them experts. Two cognitive processes account for this phenomenon. First, experts may be unable to explicitly state knowledge they have learned implicitly. Implicit learning occurs when people acquire knowledge about the relationships comprising a complex system, without necessarily knowing in advance what the variables are. Examples include solving differential equations underlying a simulated parking task (Broadbent, Fitzgerald, & Broadbent, 1986) and predicting where a light will appear on a computer screen in a serial learning task (Willingham, Nissen, & Bullemer, 1989). In these situations, people have encountered a complex task, observed the variables in operation in an unselective manner, and attempted to store the contingencies among them (Berry, 1993). Essentially, people implicitly learn these complex system and the relationships comprising it by "mucking about." One of the results of implicit learning is that the resulting knowledge is relatively inaccessible to free recall (Berry, 1993). Experts who have implicitly constructed domain-specific knowledge may not be able to articulate what they know.

Second, experts may be unable to articulate cognitive processes that have reached a level of automaticity. According to Anderson (1993), this situation exists when people explicitly learn new skills or knowledge by using language to mediate a cognitive production, such "determine the cause of a performance gap" or "select an appropriate intervention to address the cause of the gap." With successive tuning, the production fires automatically, without invoking any mediating language. The result is automatic, fluent performance—without the ability to report on the cognitive aspects of the performance itself.

One way to avoid potential problems associated with expert self-report is to employ cognitive task analysis methods. The Pathfinder Scaling Algorithm is one such method (Schvaneveldt, 1990; Interlink, 1994). This software program transforms participants' pair-wise ratings of related concepts into a semantic network—a concept map comprised of nodes (the concepts) and links that depict the relationships among the concepts.

A Pathfinder-derived concept map of a discipline could supplement existing representations created using expert self-report. One opportunity for using Pathfinder to map a discipline lies in the area of human performance technology (HPT): "...a set of methods and procedures, and a strategy for solving problems, for realizing opportunities related to the performance of people. It can be applied to individuals, small groups, and large organizations" (ISPI, 2001). As no cognitive task analysis of HPT has been conducted to date, this study sought answers to the following three research questions:

1. To what extent are Pathfinder-derived coherence scores associated with other measures of HPT expertise?
2. How do experts in the field organize their knowledge of HPT?
3. To what extent do experts organize their HPT knowledge differently than novices?

Literature Review

This section defines key Pathfinder concepts and addresses the literature relevant to each of the study's research questions. In addition to generating concept maps that represent domain knowledge without the complications associated with expert self-report, Pathfinder generates three measures employed in this study: coherence, relatedness, and similarity. Table 1 describes these measures.

Table 1

Definition, Uses, and Examples of Coherence, Relatedness, and Similarity Scores (adapted from Villachica, 2000)

Measure	Definition	Uses	Examples
Coherence (Theoretical Range = -1.0 to +1.0)	A Pearson Product-Moment correlation indicating the internal consistency of ratings within an individual's or group's set of concept ratings (Interlink, 1996).	A coherence score for an individual's or group's set of concept ratings calculated. This score is compared to that of other individuals.	Student coherence scores obtained prior to instruction are compared to those obtained after instruction to determine if learning occurred. .
Relatedness (Theoretical Range = -1.0 to +1.0)	The Pearson Product-Moment correlation between sets of concept ratings (Interlink, 1996).	The comparison of an individual's or group's set of concept ratings to another's.	The proximity matrices of students are correlated with a referent matrix containing the averaged responses of a panel of experts.
Similarity (Theoretical Range = 0 to +1.0)	The proportion of shared links in two concept maps using the same terms. The ratio of shared neighborhoods in two Pathfinder networks (Interlink, 1996).	The Pathfinder networks of an individual or group are compared to those of another.	The Pathfinder networks of students are compared to their instructor's. The resulting similarity scores are used to predict performance on a test.

Coherence and Expertise

Since the knowledge structures of experts are more organized than those of novices, experts in a given domain should possess relatively higher coherence scores. The higher the coherence score, the greater the internal consistency of the concept ratings. Four studies have investigated the relationship between coherence and expertise in different domains. However, results have been uneven, indicating a need for additional replication.

Three of these studies found a correlation between coherence and expertise. In a classroom setting, Housner, Gomez, and Griffey (1993) investigated the extent to which coherence scores and other knowledge structures would predict performance in a physical education preservice course. They found a moderate correlation between coherence and a simulated teaching activity ($\underline{r} = .63$). Gaultieri, Fowlkes, and Ricci (1996) investigated the effectiveness of training that eight Navy and Air Force pilots received over a five-day workshop. This training consisted of pre-briefings, simulated missions, and debriefings. The pilots were divided into two teams of four pilots each, with each participants rating concept pairs on the first, third, and fifth days. Results of a repeated measures analysis of variance revealed a statistically significant increase in participants' coherence scores over time ($\underline{f}2,14 = 11.55$. $\underline{p} < .001$). In a similar study, Stout, Salas, and Kraiger (1997) studied 12 naval aviator trainees enrolled in a one-day, complex training program addressing aviation teamwork and communication skills. The researchers reported that course attendees earned higher mean coherence scores than a control group who received no training ($\underline{t} = 2.70$, $\underline{p} < .01$, $\underline{M}_{trainees} = .63$, $\underline{M}_{control} = .26$).

One study did not find a relationship between coherence scores and domain expertise. Dorsey, Campbell, Forste, and Miles (1999) used Pathfinder networks to create concept maps that evaluated relationships generated by 88 computer users and compared them against the scores of four subject matter experts. Their results indicated that coherence scores were not significantly related to any of the concept map scores.

Within the domain of HPT, coherence scores would conceivably be positively correlated with several measures of expertise. Experts in HPT are members of a community of practice that has its roots in academe. As a result, experts can be expected to present at conferences, write articles, and author books. They can be expected to have spent at least 10 years developing their expertise (Ericsson, 1996).

Organization of HPT Domain Knowledge

The organization of HPT domain knowledge can be viewed in terms of existing expert representations of the domain and the extent to which a Pathfinder-generated concept map could supplement these existing models.

Existing expert representations of HPT. Given the depth and breadth of HPT, a variety of experts have authored conceptual and procedural representations of the discipline. Each representation depicts an expert's organization of his or her HPT expertise. Conceptual representations place HPT within theoretical contexts and illustrate the relationships among its components. Procedural representations illustrate the steps comprising an HPT process.

Stolovitch and Keeps (1999) provide both conceptual and procedural representations of HPT. In their conceptual model, the authors depict external and organizational environments that influence internal requirements related to human performance. Once articulated, these requirements trigger behaviors that produce accomplishments, which are subjected to verification. Accomplishments that are aligned with business requirements are accepted; those that are not aligned are subjected to subsequent alteration in behaviors, which change the organization's accomplishments. Their procedural representation of HPT consists of an iterative, 10-step process that begins with the identification of business requirements and concludes with monitoring and maintaining performance interventions. At this point, the process can repeat itself, leading to the identification of new requirements and subsequent interventions.

Addison (2001) provides a conceptual view of HPT in his Performance Consultant HPT Landscape. This representation of the discipline depicts the interaction of two conceptual and two procedural dimensions that comprise the landscape:

1. Levels of the environment, ranging from the worker to society (conceptual);
2. Principles of performance technology (conceptual);
3. Systematic approach, starting with need and ending with evaluate (procedural); and
4. System(s) view point, beginning with conditions and ending with feedback (procedural).

The International Society for Performance Improvement has created its own procedural representation of HPT. This process model focuses on a systematic combination of performance analysis, cause analysis, and intervention selection (ISPI, 2001). The majority of steps comprising the HPT model contain additional conceptual information providing additional detail about a given step.

Pathfinder representations of expertise. In addition to the conceptual and procedural representations used to depict expert's organization of HPT, one can use Pathfinder networks to represent this domain-specific expertise. The end result of Pathfinder analysis is a concept map that depicts a semantic network representing a domain, such as HPT. These concept maps are intended to represent the knowledge structures that humans store in their minds (Jonassen, Beissner, & Yacci, 1993).

Researchers have employed Pathfinder-derived concept maps to study the nature of expertise in some 13 studies and nine different domains, ranging from aircraft combat to programming to electronic troubleshooting to medicine (Villachica, 2000). In a similar vein, Pathfinder-derived concept maps could depict the way in which HPT experts organize their domain knowledge, providing another representation of this complex discipline.

Novice/Expert Differences in the Organization of HPT Knowledge

It is not surprising that novices and experts exhibit different levels of domain-specific performance. A well-established line of research traces the sources of these performance differences to the organization of cognitive structures in memory. De Groot (1978) and Chase and Simon (1973) demonstrated that expertise in chess is partially attributable to the organization of memory. Chess masters possess more highly organized and complex structures in long-term memory than chess experts, who possess more organized and complex structures than non-experts. These differences in domain knowledge allow chess masters to employ a larger visual scan than chess novices (Reingold, Charness, Pomplun, & Stampe, 2001). Similarly, Chi, Feltovich, and Glaser (1981) report that physicists sort physics problems differently than novices, with experts' organizational strategies revealing more sophisticated cognitive structures, based upon their knowledge of the "deep structure" of the domain.

Pathfinder-related studies that address novice/expert differences in domain-specific cognition have found that experts tended to exhibit greater degrees of intragroup agreement than novices. That is, the relatedness, similarity, and coherence scores of experts tended to be more similar than those of novices. For example, Schvaneveldt, Durso, Goldsmith, Breen, and Cooke (1985) conducted a discriminant analysis using Pathfinder measures that successfully predicted novice and expert performance in a fighter pilot task. Schvaneveldt, Durso, and Dearholt (1989) employed Pathfinder-produced concept maps to study differences in the ways in which biology graduate students ("experts") and undergraduate students ("novices") organized their knowledge of biology. Schvaneveldt, Beringer, Lamonica, Tucker, and Nance (2000) used Pathfinder to demonstrate differences in the priorities that novice and experienced commercial aircraft pilots assign to information viewed during the phases of a flight. Thompson (1992) employed Pathfinder-based measures to reveal differences in the organization of domain knowledge among expert, non-expert, and novice nurses.

Given the consistency of these findings, one should expect to find novice-expert differences in the organization of HPT knowledge. That is, the Pathfinder-related measures of an operationally defined set of experts should be more like each other than they are like those of a set of novices.

Methodology

Participants and Procedure

ISPI issued invitations to participate in the study to approximately 4,500 of its 6,000 members (75 percent). ISPI published the invitations on two occasions, the first invitation in its online newsletter ISPI Quick Read. After 14 days, only 38 people had responded to this invitation. ISPI then emailed a second invitation to its members two weeks later. With this invitation, another 103 persons had responded, making a total of 141. Of those, 4 people had submitted duplicate data sets, which were subsequently removed from the study. Of the 137 people who had completed the survey, 73 went on to complete all 435-concept ratings. Thus, the overall response rates to the study were 2 and 1 percent, respectively.

The researchers drafted an initial list of 50 HPT-related concepts based upon a review of the Handbook of HPT (Stolovitch & Keeps, 1999). Acting as the operationally defined referent experts for the study, the ISPI 2000-2001 Board participated in a modified Delphi process that resulted in a final list of 30 HPT concepts that would be employed in the study. ISPI members were invited to participate in the study via two methods. One, a general announcement was published in the ISPI Quick Read newsletter, and second, individual invitations were emailed. The second section of both the ISPI Quick Read article and the email invitation contained an informed consent form. Subjects who agreed to participate in the study indicated their agreement by clicking on a link that directed them to a website used to collect demographic data and concept ratings. In order to maintain confidentiality, all data were aggregated into a single computer file using the computer to assign unique, anonymous participant identification codes. Once subjects had entered their responses into an online dataset, all names were deleted from the file, thereby guaranteeing the anonymity of all participants and protecting subjects against unintentional disclosure outside the experiment.

The website consisted of the several pages, which participants completed in order. After viewing a welcome page that described the purpose of the study, participants viewed instructions about rating HPT concepts. The practice component comprised of the next two pages of the web site. In the first page, participants then viewed a list of practice terms, which appeared next to radio checkboxes. Participants could click next to any term they did not know. In the next page, participants completed a set of practice ratings. The survey component of the web site consisted of a single web page that participants completed to provide information about themselves. The ratings component of the web site consisted of two pages. In the first page, participants viewed the complete list 30 HPT concepts; with the option to check any terms they did not know. In the next page, participants rated up to 345 randomly presented pairs of HPT concepts, checking on the radio buttons comprising a rating scale to assign lower numbers (1-4) to unrelated pairs and higher numbers (6-9) to related pairs. Participants assigned a "5" to concept pairs they did not know or could not rate. The last pages of the web site thanked participants and allowed them to view additional information about the HPT Research Group conducting the study. The concept ratings participants provided were then stored as proximity matrices for subsequent Pathfinder analysis.

Results

Coherence and HPT Expertise

Table 2 summarizes the measures, survey items, number of respondents, means, standard deviations, and standard errors used in the regression analysis of coherence scores.

Table 2

Descriptive Statistics Used in the Regression of Coherence Scores on Measures of HPT Expertise

Measure	Item	Statistics
Coherence scores	Not applicable	N = 73 M = 0.324 SD= 0.153
Years HPT practitioner	How many years have you been a practitioner of human performance technology?	N = 137 M = 11.161 SD = 8.239
Number of juried presentations	How many JURIED presentations relating to HPT have you written or co-written?	N = 137 M = 3.321 SD = 11.758
Number of non-juried presentations	How many NON-JURIED presentations relating to HPT have you written or co-written?	N = 137 M = 4.409 SD = 8.839
Number of juried articles	How many JURIED articles relating to HPT have you written or co-written?	N = 137 M = 0.744 SD = 3.097
Number of non-juried articles	How many NON-JURIED articles relating to HPT have you written or co-written?	N = 137 M = 2.007 SD = 6.026
Number of book chapters	How many book chapters relating to HPT have you written or co-written?	N = 137 M = 0.774 SD = 3.132
Number of books	How many books relating to HPT have you written or co-written?	N = 137 M = 0.197 SD = 1.028

To determine the relationship between Pathfinder coherence scores and other measures of expertise, the researchers employed a multiple linear regression analyses that regressed coherence scores on the number of years as an HPT practitioner, number of juried presentations, number of non-juried presentations, number of juried articles, number of non-juried articles, number of book chapters, and number of books the participant had either written or co-written. To control for Type I error, alpha was set at .05. All variables were entered at once. The multiple linear regression produced statistically significant results (r = .458, p = .026), accounting for 21 percent of the variance in coherence scores. As depicted in Table 3, the only statistically significant independent variable contained in the equation was the number of books the participant had written or co-written. The other independent variables did not reach levels of statistical significance. The magnitude of this correlation is weak, although it approaches the moderate threshold of .5.

Table 3

Regression Analysis Summary for HPT Expertise Variables Predicting Coherence Scores

Variable	**Coherence (n = 73, r^2 = . 0.210)***		
	B	**SE B**	β
Years HPT practitioner	0.0006	0.002	0.027
Number of juried presentations	-0.0005	0.007	-0.012
Number of non-juried presentations	-0.0049	0.007	-0.149
Number of juried articles	0.0056	0.029	0.033
Number of non-juried articles	0.0098	0.013	0.126
Number of book chapters	-0.0025	0.016	-0.020
Number of books	0.2747	0.067	0.468*

p < 0.05

It should be noted, however, that only 9 of 137 participants who responded to this item on the demographic survey had written a book. Stevens (1992) notes that statistical procedures based upon regression are mathematical maximization procedures may capitalize on chance and artificially increase alpha, especially when the number of subjects is not large relative to the number of variables. Thus, the results obtained in this study may not replicate in another sample.

Organization of HPT Expertise

As a measure of the internal consistency of a participant's concept ratings, coherence scores can be used as an operational indicator of domain expertise (Interlink, 1994). To identify the participants who would act as the expert HPT practitioners in this study, the researchers identified all participants with coherence scores greater than 0.4 (n = 21, M = .4976, SD = .1309) (Schvaneveldt, personal communication, June 23, 1998). The researchers then averaged the concept ratings of these operationally defined experts and subjected the results to Pathfinder analysis, which produced the following concept map. Figure 1 represents the organization of a statistically derived, "averaged expert's" cognitive organization of HPT.

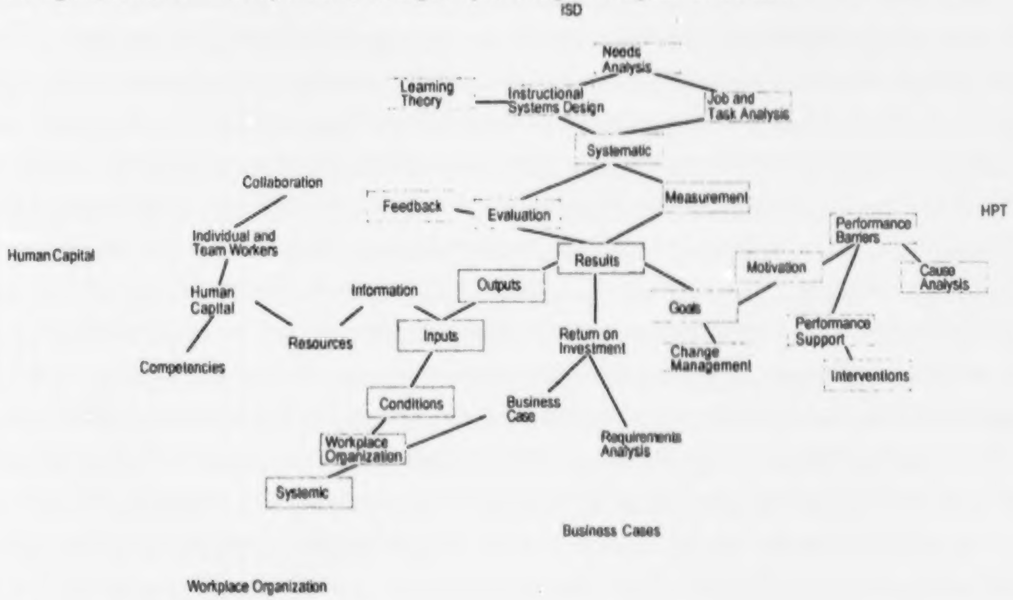
ISD
Needs Analysis
Learning Theory
Instructional Systems Design
Job and Task Analysis
Systematic
Collaboration
Feedback
Evaluation
Measurement
HPT
Individual and Team Workers
Human Capital
Performance Barriers
Results
Motivation
Cause Analysis
Human Capital
Information
Outputs
Goals
Resources
Inputs
Return on Investment
Performance Support
Competencies
Change Management
Interventions
Conditions
Business Case
Workplace Organization
Requirements Analysis
Systemic
Business Cases
Workplace Organization

Figure 1. Expert Concept Map

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The key concept in the map is represented by "*results*," which is linked to four other sets of concepts. The *first* set branch of concepts contains the terms "*learning theory*, "*ISD*," "*needs analysis*," "*job and task analysis*," "*systematic*," "*measurement*," "*evaluation*," and "*feedback*." The organization of these concepts indicates that experts employ ISD and its related components to obtain results. The *second* branch of concepts related to "*results*" contains the terms "*goals*," "*change management*," "*motivation*," "*performance barriers*," "*cause analysis*," "*performance support*," and "*interventions*." These terms form the basis of HPT theory and reflect its behavioral roots. The organization of these concepts indicates that experts employ HPT theory to obtain results. A *third* branch of concepts related to "*results*" contains the terms "*Return on Investment*", "*business case*," and "*requirements analysis*." Experts use requirements analysis to build business cases from which they can predict a return on investment that quantifies obtained results. The organization of these items indicates that experts employ business-related measures to obtain results. A *fourth* branch of concepts related to "*results*" is more complex and consists of two separate subsets. The first subset consists of the terms "*outputs*," "*inputs*," "*conditions*, "*work organization*," and "*systemic*." Systemically accounting for workplace organization, experts assess the conditions of performance, their inputs, and their outputs in determining performance results. It is also important to note that "*workplace organization*" is also linked to "*business case*," indicating that experts use the context of the workplace to create such cases. The second subset consists of the terms "*information*," "*resources*," *human capital*, "*competencies*," "*individual and team workers*," and "*collaboration*." The organization of these terms indicates that collaboration among individual and team workers builds human capital, which can be described in terms of competencies. Human capital is linked to resources. Information about resources allows resources to be used as inputs to performance-which ultimately lead to outputs and results.

Novice/Expert Differences in the Organization of HPT Knowledge

To explore differences in the organization of HTP knowledge among an operationally defined set of novices and experts, the researchers employed a median split. In this instance, experts were operationally defined as any participant possessing a coherence score one standard deviation above the mean ($n = 8$, $M = .1035$, $SD = .0553$). Novices were operationally defined as any participant possessing a coherence score one standard deviation below the mean ($n = 8$, $M = .1353$, $SD = .0161$). Table 4 summarizes means and standard deviations associated with experts' and novices' similarity and relatedness scores.

Table 4
Numbers, Means, and Standard Deviations for Novice and Expert Similarity and Relatedness Scores

Group	Measure of Knowledge Organization					
	Similarity Scores			Relatedness Scores		
	N	M	SD	N	M	SD
Expert	8	0.1353	0.0553	7	0.0659	0.0421
Novice	8	0.1035	0.0161	8	0.0322	0.1122

To determine if the similarity and relatedness scores of experts were more similar to each other than they were to novices, the study employed a multivariate analysis of covariance (MANCOVA). Novice/expert designation acted as the independent variable. Similarity and relatedness scores acted as the dependent variables. As coherence scores were used to operationally define groups and represented a source of variation beyond the control of the researchers, they were used as a covariate in the analysis. To control for Type I error, alpha was set to .05.

The results of the MANCOVA indicated that the group effect was statistically significant (Wilks' Lambda = .544, $f(1, 14) = 4.615$, $p = .035$). Eta-squared (1-Wilks' Lambda) revealed that approximately 46 percent of the variance in the linear combination of the dependent variables was associated with group differences. As summarized in Table 5, tests of between-subjects effects revealed that group differences were attributable to similarity scores alone.

Table 5
MANCOVA Results for Similarity and Relatedness Scores as a Function of Group and Coherence

Source	Dependent Variable	df	SS	MS	f
Covariate (Coherence)	Relatedness	1	0.0035	0.0035	.439
	Similarity	1	0.0065	0.0065	5.820*
Group	Relatedness	1	0.0065	0.0065	.816
	Similarity	1	0.0110	0.0110	9.803*
Residual	Relatedness	12	0.0952	0.0079	
	Similarity	12	0.0135	0.0011	
Total	Relatedness	15	.137		
	Similarity	15	.249		

* $p < 0.05$

Discussion

Coherence and HPT Expertise

Although the number of years participants had been a HPT practitioner was expected to weakly correlate with participants' coherence scores, it did not. Although the sample exceeded Ericsson's (1996) threshold of ten years to reach expert status in a domain, no correlation with coherence scores or any other measure of expertise was found. Since the number of non-juried/juried presentations and publications are based upon recognition in the field and the results of peer review, it was thought that these indirect measures of HPT expertise would correlate with coherence scores. Although these measures correlated among themselves, they did not correlate with coherence; book production alone correlates with coherence.

Three possible explanations for the significant relationship between coherence scores and authoring an HPT-related book include: 1) desire to create detailed conceptual structures or schemas, 2) tolerance for tedium, and 3) low sample size. The correlation between coherence scores and writing an HPT-related book could be the result of the capacity or desire of an author to develop highly detailed and organized cognitive structures or schemas. Books are representations of schemas, divided into chapters and sections. Perhaps book authors possess such schema, making it more likely that their cognitive maps would correlate with coherence scores.

Another conceivable reason for the correlation between book authorship and coherence scores may be book authors' tolerance for tedious activity. Authoring depends on patience, self-discipline, and a large devotion of time and energy. Authoring also requires one to switch attention between small details and large-picture views frequently. The structure of this study's pair-wise rating activity required the same sort of mental activity for an extended period of time (between 30 minutes and one hour). Perhaps individuals who were able to complete the ratings and stay on task for this time are also individuals who can author books.

Finally, the low sample size employed in the study may have precluded obtaining significant results. In addition to artificially increasing alpha, low sample size may have lacked adequate statistical power to detect otherwise significant relationships between coherence scores and measures of HPT expertise. Replicating this study with a larger sample and modifications to the website to decrease experimental mortality (that is, the number of participants who dropped out of the study between completing the information page and their concepts) could produce less ambiguous findings.

Organization of HPT Expertise

The expert concept map is similar to other expert representations of HPT, suggesting the convergent validity to this finding. The information and resource components of the human capital branch of the concept map roughly correspond to the organizational environment of Stolovitch and Keeps' (1999) conceptual representation of HPT. The business case branch corresponds to their components of business goals/objectives and internal requirements. Where Stolovitch and Keeps focus on accomplishments and their verification, the expert concept map focuses on results. Additional similarities can be found comparing the expert concept map to Stolovitch and Keep's procedural representation of HPT. The business case branch of the concept map addresses Stolovitch and Keeps' steps for identifying business and performance requirements. Likewise, the HPT branch of the concept map addresses the steps "define performance gaps, specify gap factors, and select interventions."

One of the underlying principles of the HPT landscape model (Addison, 2001) is a focus on results and outcomes. The expert concept map also communicates a focus on results, which is the key concept on the map. Sections related to ISD, human capital, business cases, and HPT are linked to obtaining results. The systems and business case portions of the Addison model are similar to the ISD systems and business case branches of the expert concept map. The predictive validity of the expert concept map could be determined by determining the extent to which it predicts performance in HPT. For example, concept ratings could be obtained from previous winners of ISPI awards. These scores could be compared against a control group who did not win such awards. Subsequent statistical analysis could determine the extent to which Pathfinder-derived relatedness, similarity, and coherence scores predicted the award-winners. In addition to providing a unique perspective of HPT as a discipline, practitioners and researchers could employ the concept map in different ways. For practitioners, the expert concept map can assist in the creation of HPT competencies. The different branches of the map could represent the major HPT competencies. The organization of subordinate and related competencies could also be derived from the concept map.

Experienced practitioners could use the concept map as a "mind tool" to introduce new practitioners to HPT. Specifying the nature of the links could help learners construct their knowledge of the discipline (Jonassen, 2000). The similarity measure that Pathfinder derives from the concept map could also be used as an assessment tool for practitioners and researchers alike. As new practitioners gain experience solving increasingly difficult problems in the domain, their similarity scores should increase, indicating that their mental map of HPT is increasingly like those of experienced practitioners. Their development within this community of practice could be modeled statistically, with different stages of practitioner HPT development lending themselves to different learning and other types of performance supporting interventions. If such stages and interventions could be determined, then whole programs could be designed to help novices move along a continuum of HPT expertise, potentially improving the quality of HPT practice while decreasing the time required obtaining expert-like performance.

Novice/Expert Differences in the Organization of HPT Knowledge

The similarity scores of experts are higher than those of novices, indicating that expert concept maps are more like those of other experts than of novices. This finding replicates the results of other studies comparing the organization of expert and novice cognition. Specifically, experts share a greater proportion of the links in their individual concept maps with those of the "averaged expert's" concept map (p. 8) than do novices (14 percent versus 10 percent, respectively). It should be noted, however, that the small sample used in this analysis may not provide replicable results.

Conclusion

While the results obtained in this study are intriguing and suggest potential uses of the expert concept map and related Pathfinder-based measures in HPT, these results are based upon a small sample. Replication with a larger sample is certainly warranted.

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The Relative Effectiveness Of Structured Questions And Summarizing On Near And Far Transfer Tasks

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Abstract

This study is to compare the effect of two learning strategies: summarizing and structured questions on near and far transfer tasks. The hypothesis is that the structured questions will better activate metacognitive and critical thinking skills than summarizing so that it will better facilitate learning transfer. However, the results do not show any significant difference between two strategies on transfer tasks. Possible reasons that the students failed to activate metacognitive skills or critical thinking skills are discussed. Recommendations to maximize the effect of structured questions on transfer tasks are also discussed.

Introduction

Various studies (Sternberg & Frensch, 1993; Salomon & Perkins, 1989; Perkins & Grotzer, 1997; Kosonen & Winne, 1995; Stolovitch & Yapi, 1997) have been conducted in the field of educational research in general, and instructional systems design in particular, on how to facilitate transfer of learning. The early research on learning transfer focused on the role of practice. Most early researchers agreed that increased amounts of practice would increase transfer (Thorndike, 1913; Gagne & Foster, 1949; Hovland, 1951). More recently, one major interest is the role of metacognitive strategies and critical thinking in learning transfer. Most of the research focused on teaching metacognitive strategies and critical thinking skills. However, relatively little research has focused on the activation of metacognitive strategies and critical thinking skills that ultimately promotes learning transfer (Forster, 1996).

This study explores the possible way to activate metacognitive strategies and critical thinking skills through the use of reflective activities, like summarizing or answering structured questions after reading. Metacognitive strategies refer to the regulation and control of cognition. Despite differences, most researchers would agree critical thinking involves the intentional application of rational, higher order thinking skills that include analysis, synthesis, problem recognition and problem solving, inference, and evaluation (Angelo, 1995). Structured questions in this study refer to a set of generic questions that are not associated with specific content of any articles. Also, this research studies the effect of metacognitive and critical thinking skill activation on near and far transfer. Near transfer is the application of learning to situations similar to those in which initial learning has taken place. In contrast, far transfer is the application of learning to situations dissimilar to those of the original learning events.

The purpose of this study was to compare the relative effectiveness of structured questions and summarizing on near and far transfer tasks. More specifically, this study was designed to address the following questions:

1. Will students who answer specific structured questions perform better on near transfer task than students who are simply asked to summarize the content?
2. Will students who answer structured questions perform better on far transfer task than those who only write a summary of an article?

It was expected that students who write reading reactions based on structured questions would outperform significantly those students who only write a summary of an article. This was because the structured questions in this study are higher order cognitive questions, which might stimulate the development of students' cognitive strategies beyond simply memorizing content (Sanders, 1966). In other words, the structured questioning format requires the use of more metacognitive strategies and critical thinking skills. It requires not only analyzing skills but synthesizing, judging, and evaluating skills. As a result, the students who answer structured questions might have a better retention of the content while applying what they have read than those who only summarize the content. With the better retention, the structured questions group might do better on near transfer task.

It was further expected that the structured questions group will perform significantly better on far transfer task than the summary group. This is based on the fact that structured questions in this study might activate the application of analyzing, synthesizing and evaluating skills that are part of metacognitive strategies, and critical thinking skills. This is a kind of skill activation (Salomon, 1979). According to some researchers (King, 1992; Pressley, Wood, Woloshyn, Martin, King, & Menke, 1992), generic questions (or structured questions in this study) are very effective at promoting critical thinking skills because they will induce inference, evaluation, and verification. The writing of an EPSS (Electronic Performance Support Systems) product evaluation report, as a far transfer task, also involves applying synthesizing and evaluating skills. In contrast, although summarizing may also involve cognitive strategy activation, most people will focus on content learning when they summarize (Garner, 1987).

Method

Participants

Sixty-six undergraduate students (7 males, 59 females) from a class of 101 students at Florida State University participated in the study as a part of an outside class assignment and a class activity. Although 101 students participated in transfer tasks (as a class activity), only 66 students submitted the outside class reading assignment. So the final result was based on the 66 students who participated in both activities in this study. Most students are sophomores or juniors who major in or plan to major in elementary, special, and early childhood education. All the students were enrolled in a course entitled Introduction to Educational Technology. Some students may know of the term CBT (Computer-Based Training), but they had never been exposed to the idea of EPSS (Electronic Performance Support Systems), the content topic of this study. The students' participation in this study was assigned as part of their class activities. They did not get any extra credit points for participating, and their participation in this research study did not affect their grade or any negative consequences.

Materials

Two articles about Electronic Performance Support Systems (EPSS) were used for the reading assignment. EPSS is an interactive computer-based environment that provides on-the-job and just-in-time support to facilitate task performance and product development. It usually consists of a library and information support system, customized tools, learning function, and an interactive expert system. The first article is Leighton's (1996) *What is an EPSS*? It introduces the background, definitions, goal, and components of EPSS. The other is Sleight's (1993) *What is Electronic Performance Support and What Isn't?* In the article, Sleight identifies major characteristics of EPSS and compares examples and non-examples of EPSS. Both articles are four pages long with about 1500 words.

The EPSS product the students evaluated for the far transfer task is the Florida Curriculum Planning Tool (CPT) version 2.0. CPT was designed and developed by the Center for Performance Technology at Florida State University for the Florida Department of Education (DOE). The purpose of CPT is to facilitate teachers' planning of learning activities and units of instruction that are in compliance with Florida Sunshine State Standards. It is designed, in particular, to assist teachers in developing learning activities for any subject, grade level, strand, theme, standard, benchmark or any combination of the above. It also allows teachers to import activities developed by other teachers, and export activities they develop to share with others.

Independent Variable

The independent variable in this study is the type of reading assignment, which had two formats. One format requires the student to write reading reactions based on the given structured questions. These questions include:

- What are your gut reactions to the article?
- What do you think are the big ideas in this article?
- What are the implications for your (future) teaching or work?
- What are the implications for your learning?
- What questions does it leave unanswered?
- What is your rating of the usefulness of this article? Choose one of the following: (poor, fair, good, excellent)

The other format requires students to write a summary of the article in a free format.

Dependent Variables

The two dependent variables are near transfer and far transfer. The measurement of near and far transfer is the score on the writing of a list of EPSS evaluation criteria (near transfer) and the score on the CPT evaluation report (far transfer). The score of the EPSS evaluation criteria is determined by the number of evaluation standards that are included in the student's evaluation based on the ideas from the two EPSS articles. The total possible score is 15, representing fifteen major points mentioned in the two articles about the characteristics of an EPSS. The score on the CPT evaluation report is determined by the following assessment criteria. These criteria are adopted and modified from the principle of authentic writing assessment (Chapman, 1990; Hart, 1994; Frederiksen & Collins, 1989). The authentic writing assessment examines a student's writing holistically. One major characteristic of this method is that the students' total scores consist of scores representing different dimensions which include content, organization, style, and mechanics. The formal writing assessment usually emphasizes writing style, mechanics of spelling and syntax, and content. However, in this study, the focus was on the content. This is because the content in the final evaluation report should reveal how well they have learned from the reading assignment, and whether any transfer has occurred. Four dimensions are used to score the evaluation report. They are listed below.

1. Focus: the main idea, theme, or point of view is clear and consistently maintained, overall recommendation about the product included. (0-3)
2. Support: arguments and conclusions are adequately supported and explained. (0-3)
3. Organization: the logical flow of ideas is clear and related. (0-3)
4. Content: Number of major points mentioned in the EPSS articles included. (0-6)

On the basis of the above definitions, more detailed scoring principles were developed for each dimension. A three-point scale was used for the first three dimensions of Focus, Support, and Organization. A six-point scale was used for the dimension of Content because the content was the key factor that was associated with the transfer of learning in this study. Thus, the total possible score for the far transfer task is 15 points.

Procedure

At the beginning of the course, the students were told about the study. The participants were randomly assigned to one of two groups: one was told to write reading reactions based on the structured questioning format, the other was told to write summaries of the articles in a free format. The experiment began in the third week of class. Both groups were asked to read two articles on the topic of EPSS, and then either answer structured questions or write a summary as an outside class assignment. They were required to submit their reading assignments at the beginning of the fourth week class. During the fourth week of class, the students were required to do two tasks in class, in an hour, without access to other materials. The first task was to write a list of an evaluation criterion for evaluating EPSS products based on what they had read. The second task was to write an evaluation report of the CPT. The students finished these two tasks in front of the computer in the computer lab. They were asked to browse the CPT first and write down their evaluation in essay format. The evaluation criteria and report were collected by the researcher after the class.

The students' evaluation reports were scored by the researcher and another doctoral student whose major is measurement and testing in the College of Education. Both raters have experience in teaching and writing assessment. The following procedure was used in scoring the students evaluation criteria and the evaluation report of CPT. Before starting the grading process, the raters read two EPSS articles and the exercise instructions to get familiar with the content and purpose of this study, which was very important for another rater. The researcher assigned the numbers one to sixty-six to participants for scoring purposes. Neither rater knew the student's treatment group when grading his or her writing so as to avoid any bias to a specific group. Based on the scoring guide for grading, the two raters tried to score three evaluation reports together as a test. They then discussed the differences and came to a consensus for further grading. Finally, the two raters finished grading all sixty-six evaluation reports individually. To ensure the reliability and consistency between the two raters, correlation coefficients for both scores were calculated using the statistical software package, SPSS. The results are shown in Table 1.0. Pearson's correlation coefficients for the two scores are .80 and .73. They are both statistically significant at the .01 level.

After finishing the scoring, the researcher averaged the two raters' given scores as the final score for each student. Two scores of each student on near and far transfer tasks were then input into the SPSS data worksheet for data analysis.

Table 1.0 Correlations Between Two Raters on Transfer Task Scores

Correlation	Rater	A	B
Evaluation Criteria	A	1.00	0.80
	B	0.80	1.00
Evaluation Report of CPT	A	1.00	0.73
	B	0.73	1.00

Note. Correlation is significant at 0.01 level.

Results

Relative Effectiveness on Near Transfer Task

The score of each student's performance on near transfer task was measured by the number of key points included in their list of evaluation criteria. The possible total score is 15, which represents 15 key points mentioned in the two EPSS articles. Table 2.0 presents the means, standard deviations, and range of scores for the students' EPSS evaluation criteria. The average score of the structured questions group ($M = 3.35$) was lower than the average score of the summary group ($M = 3.85$), but the difference was not statistically significant, $F(1, 64) = 2.257$, $p > .05$.

Table 2.0 Mean Scores of Writing a List of Evaluation Criteria

Measure	Group	N	M	SD	Range
Evaluation Criteria	Structured Question	34	3.35	1.00	2.00-7.00
	Summary	32	3.86	1.68	1.00-9.00
	Total	66	3.60	1.38	1.00-9.00

Note. The possible total score for evaluation criteria is 15 points.

Relative Effectiveness on Far Transfer Task

The student's performance on the far transfer task was determined by their evaluation report of Curriculum Planning Tool (CPT). The evaluation report was in essay format. The scoring criteria included four dimensions, focus (3 points), support (3 points), organization (3 points), and content (6 points) for a total possible score of 15 points. The means, standard deviations, and range of scores are displayed in table 3.0. Again, the summary group outperformed the structured question group. The average score of the summary group ($M = 9.23$) is a little higher than the average score of the structured question group ($M = 8.94$). However, the difference is not statistically significant. The result of a one-way ANOVA showed $F(1, 64) = .19$, $p = .664$. With $p > .05$, the null hypothesis could not be rejected.

Table 3.0 Mean Scores of the Evaluation Report of CPT

Measure	Group	N	M	SD	Range
Evaluation Criteria	Structured Question	34	8.94	2.69	3.00-14.50
	Summary	32	9.23	2.77	5.00-15.00
	Total	66	9.08	2.71	3.00-15.00

Discussion

The discussion will focus on the factors that might have affected the transfer tasks as a whole, since the possible reasons for a lack of statistical significance should be similar for both the near transfer task and the far transfer task.

Although there were no previous studies that directly measured the effects of structured questions on transfer tasks, many studies (Applegate, Quinn, & Applegate, 1994; Sanacore, 1984; Andre & Anderson, 1978; Kosonen & Winne, 1995; Nisbett, 1993; Perins & Grotzer, 1997) did suggest that metacognitive skills and critical thinking skills facilitate better learning. The structured questions used in this study were supposed to activate metacognitive skills and critical thinking skills. Thus, theoretically, the forced use of such skills as analyzing, synthesizing and evaluating in answering structured questions should have promoted reading comprehension and produced better understanding in applying knowledge and skills obtained through reading articles.

Contrary to what was expected by theoretical assumptions, the structured questions group did not perform any better than the summary group on both near transfer task and far transfer task. The lack of a significant effect may be due to a number of factors: failure to activate the students'metacognitive skills or critical thinking skills, the lack of student motivation to the experiment, inadequate practice for the treatment, and the unfamiliar topic area with a lot of technical jargon in the articles used for the current study.

Failure to Activate Metacognitive Skills or Critical Thinking Skills

There are several possibilities that the students failed to activate metacognitive skills or critical thinking skills. One possible explanation is that most students' answers to structured questions were about the article rather than the reflective thinking on the content of the article. The purpose of using structured questions in the current study was to force the student to apply critical thinking skills such as analyzing, synthesizing and evaluating skills to reflect on the implications of the content of the articles in their future learning or teaching. However, while answering questions like "what are your gut reactions to this article?", "what are the implications for your future teaching? and "what are the implications for your learning?", most students failed to recall details of the content of EPSS such as its components and functions, but rather focused on their general feelings. Those general feelings were emotional, and many were negative. For example, several students expressed their concerns that the computer would replace humans because of EPSS, which was not what they wanted to happen. Others complained there were too many technical terms in the articles that were difficult for them to understand at the beginning.

On the other hand, the summary group at least applied their own metacognitive strategies to summarize the main idea and its supporting ideas. The group's sole focus on the content might have helped them recall the content of articles when they were required to write the list of evaluation criteria for EPSS product evaluation.

Another possibility of the failure of skill activation is that the structured questions in this study might have been too difficult to these students. This was inferred from an analysis of the students' answers to implication questions. Most of them centered around describing the content of the articles rather than the implications for practice. If the students did not understand what inferences are, or simply did not answer the question, it is unlikely the structured questions had the desired effect.

Lack of Students' Motivation to the Experiment

Participation in reading assignment phase of this study was voluntary though the participation of transfer tasks was required. However, the participation of the study had no negative effect on students' grade. The students did not get reward for performing or not performing on the tasks. That might be the reason why only around one third of 101 students submitted their reading assignments. The completion of the reading assignment of writing summaries or answering structured questions happened outside classes. The time the students spent finishing the assignment and the efforts they made were unknown. However, by reading their answers to the questions and summaries, it was somewhat obvious that many students did not put much effort into either answering the structured questions or writing summaries. Most students answered the structured questions with only one or two sentences or even left one question unanswered. Similarly, the summaries of most students were short with one paragraph of about 130 words. This may result in low retention of the content and poor performance on near transfer task among students of both groups.

Another inference is that the students did not spend the time to learn or perform, since participation did not affect their grade. Perhaps they did not perceive the task to be worth a lot of effort. This low effort could be observed in the time spent in completing the transfer tasks. The transfer tasks were designed to be completed in about 40 to 50 minutes, but most participants in this study finished the tasks in 30 minutes or less. The expected finishing time was based on the average time the students spent in two pilot tests. The first pilot test was conducted in the same course during the previous semester. The students who attended the pilot test had similar backgrounds and the average time they spent was about 40 minutes, ranging from 30 to 50 minutes. In another pilot test done in a graduate class, the average time the students spent was about 40 minutes.

Inadequate Practice of the Treatment

The short time period for the experiment might not have provided the structured questions group with enough practice on answering structured questions. The current study asked students to read two articles on the same topic within a week. The students who participated in this study were not familiar with the structured questions format for reading. Nor did they get feedback as to the accuracy of their responses. Two trials may not be adequate for them to make use of this format. In previous applications of this format as used in Construe (Lebow, Wager, Marks, & Gilbert, 1996), students received feedback after their first application which led to better responses on the second application. As a result, perhaps, the treatment was not optimized.

Unfamiliar Topic Area of Reading Material

The participants in this study had no prior knowledge of the topic of EPSS, and they were still a bit confused after reading the articles. The two EPSS articles used in this study are conceptual and well written with simple and very concise language. However, perhaps because of their conciseness, they did not provide examples to explain where the EPSS products were being used, and what they looked like. This caused problems with understanding for some students.

The limited prior knowledge of EPSS might have hindered the students' comprehension of the articles and weakened their performance on the transfer tasks. Participants in this study were from various educational majors. The course was one of the required courses for educational major students that help them establish a foundation of knowledge in educational technology. Most participants were novice computer users. When the experiment was conducted, it was in the early weeks of the course. The students were just beginning to learn Microsoft Word, and email. They had not studied educational software evaluation which was a topic to be discussed later in the semester, and is related to EPSS product evaluation. This lack of basic knowledge about evaluation may have affected their performance on the transfer task. A large number of previous studies (Hamilton, 1997; Machiels-Bongerts, et al., 1995; Wilson & Cole, 1992; Reigeluth, 1983) have indicated that prior knowledge facilitates information processing and text recall. Without related prior knowledge, transfer might be difficult to occur. When means of both summary and structured questions group scores were examined, it is evident that the average score was very low. For the first task, the total average score was only 3.60, which was 24.0% of the possible total score. The total average score of 9.08 for the second transfer task was only 60.5% of the total points which would also be considered failing performance. One assumption of these low scores is that the acquisition of knowledge never took place. Without the retention of the learning content, learning transfer would never have been occurred.

Suggestions for Future Research

While the hypotheses were not supported, the current study provides sufficient evidence that further research should be pursued in several areas for a better understanding of the effect of structured questions on transfer tasks. These areas include:

- How to monitor or control student's efforts in answering structured questions
- How to provide feedback on the adequacy of answers to structured questions
- How to provide adequate practice to better the chance of transfer
- How to assess content acquisition before determining performance on transfer tasks

Monitor or Control Student's Efforts in Answering Structured Questions

This study did not record the time the students spent to answer the structured questions. However, the students' short answers to the questions revealed that many of the students might not engage in thinking with metacognitive skills or critical thinking skills that were expected to be activated. Without the activation of the skills, the transfer of learning barely occurred. To assure the occurrence of transfer, future research may include directions that set the minimum length of each answer to the questions, and require the answer to focus on the content. Another adjustment for the research can be to ask the students to finish the reading assignment in the class. In this way, both structured questions group and summary group will have the same amount of time to finish the assignment. The time each student spends on the reading can also be recorded and analyzed.

Provide Feedback on the Adequacy of Answers to Structured Questions

One recommendation for future research is to provide feedback or a model to students for their answers to structured questions. The feedback should be directed toward getting appropriate and accurate answers to the questions related to key ideas and implications. The results of this study suggest that many students did not make use of the structured questions format well. To make sure the students answer the questions more adequately, it may be more appropriate and effective to provide each student feedback on their answers after the first reading, and show them some good examples of answers as models. The feedback may result in better application of the structured questions format and a better chance of activation of metacognitive skills and critical thinking skills.

Extend the Duration of the Experiment

It is also recommended that the duration of the experiment be extended. The results of this study indicate that students might not get used to answering the structured questions after reading only two articles. It might show significant difference if the students are required to read two more articles for two more weeks rather than to read two articles within a week. The increased amount of practice with the structured questions format may increase the possibility of activating metacognitive skills and critical thinking skills that the students have acquired before. The skill activation may in turn generate better transfer.

Assess Content Acquisition Before Determining Performance on Transfer Tasks

It is recommended that future researchers assess content acquisition before conducting transfer tasks. A test of recall may be conducted after students finish reading articles to examine whether students acquire knowledge or not.

Future research may also select another topic other than EPSS. It is recommended that participants not be familiar with the chosen topic but are interested in it because they will put in more effort and participate in the activities more actively if they perceive something as relevant and interesting (Keller, 1983). It is also recommended that the transfer task be designed so that it can be assessed properly, if not easily.

In conclusion, this study shows that under the stated conditions both structured questions and summarizing strategies are equally effective. However, it is likely that different conditions would lead to different results. That is, modified conditions in future research such as training on the use of structured questions, a meaningful and relevant task, and motivated participants might change the outcomes of this study.

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Revisiting Research Constructs in Distance Education: Enhancing Learner Interaction to Build Online Communities of Learners

Online Moderating Techniques to Promote Asynchronous Communities of Discourse

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Abstract

An upper-level class of secondary education majors learned how to moderate online asynchronous computer conferences and each student was assigned a week to develop a topic and lead a discussion on an issue dealing with media and technology. This paper details a structure of student moderated computer conferences that can be used to instill learner autonomy, a sense of ownership of student ideas, and take advantage of the reflective nature of the media

Introduction

Few would argue that interaction is an important part of any class regardless of whether the class is face-to-face, delivered at a distance or a combination of the two. Moore defined three types of interaction found in distance learning: learner content interaction, learner instructor interaction, and learner-learner interaction. He contended that learner-learner interaction would challenge future thinking and practice but noted that its use would vary depending upon the situation, ages, experiences, and levels of autonomy of the learners (Moore, 1989). Learner-learner interaction could be employed with or without the intervention of the instructor. Harasim and Yung (1993) in discussing a survey of 176 teachers and learners on the Internet reported differences found in computer-mediated communication when compared to face-to-face instruction. They discovered that when online, learner-learner group interaction became more detailed and deeper. They also found that personal communication between learners increased. Online discussion groups enable students to develop rapport for each other (Powers & Mitchell, 1997). Ahern (1995) reported that computer conferences provide opportunities for authentic peer-interaction wherein students will develop an awareness of authorship.

This case study explores learner-learner interaction in a structured environment using aspects of trained online moderation of discussions, ownership of knowledge and learner autonomy in course mostly delivered face-to-face with online asynchronous computer conferencing conducted as an enhancement to the class serving as the majority of the class homework.

The sample

The class studied was comprised of 20 undergraduate juniors and senior in various fields of secondary education. The course was the only technology requirement in their program of study. Since this was a required course, the student's level of computer experience covered a wide range. Some students were quite comfortable with computers having grown up with them in their homes and schools. Others, especially older non-traditional students, had very little experience with computers. At the least experienced level, students did have experience with using word processing programs to write papers. Along with a wide range of computer competencies, there was just as wide a range of knowledge regarding issues of technology and education.

The structure

All students underwent a two-day moderator training. The training was based on a brief practical guide to moderating online computer conferences covering issues including, what is a computer conference moderator, preparing for the conference, welcome messages, and common problems and solutions often found in conferences. The guide has been used it for both student training and faculty development. The training also included extensive classroom discussion on dealing with the lack of non-verbal cues and finding agenda behind the words. Students were also given clear written instructions directions covering what was expected of each as a conference participant.

The course syllabus showed that computer conferencing was a large part of assessment. Moderating counted for 10% of assessment and participation counted for an additional 30%. Contracting for participation has been found to be effective. Often students feel reticent to participate in an unfamiliar activity and if they are not given incentive, they will choose not to take part in the conference or infrequently post message wanting in both quantity and quality (Eastmond, 1995; Hillman, Willis, & Gunawardena, 1994; Murphy et al., 1996). Conferencing groups need time to coalesce and if participation is not mandated, this would probably not happen. A usual case is that a conferencing system is 'made available' but no more. Invariably it does not get used.

The class was divided into two conferencing groups of ten each. These groups were maintained throughout the semester. Ten is a workable number since assuming full participation, a larger group would be hard for students to keep track of, and a smaller group would tend to make the participants feel as if they always need to be 'performing' (Cifuentes, Murphy, Segur, & Kodali, 1997). The instructor modeled the first week of conferencing. Modeling is very important since students new to computer conferencing, need to know what is expected of them with as much specificity as possible. Modeling behavior and the expected discourse are two concepts that cannot be emphasized too strongly. After the week of modeled behavior, the instructor did not participate in the conferences further. The groups knew that all messages were being read by the instructor since they were often mentioned in class, but all communication regarding conferencing from the instructor was emailed to individual moderators.

Students subscribed to the Educause listserv (http://listserv.educause.edu). This provided them with briefings on issues regarding technology and education. The information found on the listserv was often used to generate topics for online discussion. Each student moderated one week of discussion while the other nine students were participants. No topics were assigned; rather each was negotiated with the instructor. The topic came from Educause or anything of interest to the student as long as it dealt with a contentious issue of technology and education.

Welcome messages

Moderators were responsible for crafting a 'welcome message', which would start his or her week of discussion. This message usually contained a four-part structure:

1. A personable introduction
2. Presentation of information
3. A minimum of four open ended question
4. The start of the issue oriented discussion with an invitation for participation

This welcome message was emailed to the instructor on Saturday for evaluation. Suggestions were made concerned with how to approach the week and whether or not the topic would work. From these suggestions, the message was rewritten and resubmitted, sometimes a number of times, until it was approved and on Sunday, it was posted on the BlackBoard course management system in a new forum.

Minimum participant responsibilities

The class discussed what was to be considered a message of substance, and it was decided that a good message would be at least a few short paragraphs in length, but more important, it needed to advance the conversation. A message just restating a previously made point, or serving no other purpose than agreement or disagreement would not be counted.

The responsibilities required of a participant were also quite defined: There messages a week were the mandated minimum.

- The first message must be in response to the welcome message within two days after its posting.
- The second message must be in response to a participant response within next two days.
- The third message could be in response to anything previously posted, or could make a new point, but needed to be posted within the next two days.
- Further messaging was encouraged but not mandated.

Responsibilities of the moderator

The moderator was charged with keeping things going while using proper moderation techniques including:

- Promoting full participation
- Using email (cc. to the instructor) to solve problems and curtail miscommunication
- Extending the discourse
- Setting a tone of inclusion
- Restating and ask for clarification
- At the end of the week, weave a summary rich in quotation detailing the major points of the week.
- At the first class of the next week, present the welcome message and summary to the entire class

Since the two-conferencing groups were segregated, half the group did not take part in any given discussion.

Findings

The conference held for both groups the final week of the course was moderated by the instructor. The discussion was based on student impressions of moderating and participating in online discussions. What worked and what did not? Was it fun? Was it too much work? Students were asked to pose their own questions as well to the group. Some themes that emerged and seemed to strike a chord with students were, that although moderating was a time consuming, many enjoyed their moderator week more than those when they were participants. Although it was generally agreed upon that moderating was more work than being a group member, many really enjoyed the sense of ownership of an engaging discussion dealing with a topic of their own.

Nearly half of the participants posted more (often many more) message than the required three. All the students, except one who couldn't see how it could fit in a beginning math course, wrote that if the equipment were available when they teach, that they would use asynchronous conferencing in their classes.

Previous computer experience was not correlated to success using computer conferencing. This may be due to the fairly simple system provided by BlackBoard, but it may also be related to a number of comments saying that the experience is closer to writing or talking than it is to running computer programs. The class, without prompting, set a tone of supportiveness and politeness in both groups. This enabled a deeper and more reflective discourse than found in discussions where the moderator was found to be terse and confrontational. The degree of respect, friendliness, and support found in the messages just 'happened'. A space of comfort and acceptance was created in both groups.

Conclusion

Online asynchronous conferencing is a useful enhancement to face-to-face classes. It enables discussions on topics that would be able to be dealt with in as much depth given the constraints of class time. Allowing students to own their words proved quite effective and allowed engaged and vibrant discussions that might have taken on a different dimension if filtered through a figure of authority. It promotes critical thinking, as well as writing. The inherent asynchronicity allows time for reflection and results in remarkably complex and insightful discourse.

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Creating an Online Community by Using ICQ Active List

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Abstract

One of the important characteristics of the Web-based courses is that they utilize different Internet tools to close the gap between the instructor and the learner. Although many different Internet tools can be used today to close this gap, there are a number of problems with the existing tools. In this paper, we introduce ICQ Active List, which has the characteristics of many Internet tools that can be used in place of all those tools to eliminate the problems. We also touch to the issue of creating an online community, which is very important in Web-based courses, and describe the principles we followed to create such a community. Most of the principles and the experience can be used to create learning communities in Web-based courses.

Introduction

One of the most important characteristics of Web-Based Instruction (WBI) is to utilize different Internet communication tools. Since almost all of the interaction vital for WBI takes place on these tools, effective use of them is directly related to the success of the courses. There a number of Internet communication tools that can close the gap between the instructors and students of WBI. These tools are course web sites, electronic mail (e-mail), electronic mailing lists (or listservs), threaded discussion groups (or Usenet newsgroups), Internet Relay Chat (IRC or chat), Instant Messaging (IM), audio conferencing (or Internet telephony), and video conferencing (Harrison, 1997; Madjidi et. al., 1999; Pattison, 1999).

Internet Communication Tools

A course web site is a combination of web pages that can hold such course related information as course syllabus, course notes, course lectures, course resources, web links to other useful web sites on the Internet, and etc. Students access course web sites through web browsers such as Internet Explorer or Netscape Navigator.

E-mail is the most popular Internet communication tool. An e-mail client, such as Microsoft Outlook Express, Microsoft Outlook, or Netscape Messenger, is enough to use this basic communication technology. When someone sends you an e-mail, it is kept on an e-mail server. When you would like to check for your e-mail messages, you use the e-mail client software to connect to the e-mail server and retrieve your e-mail messages. For WBI, e-mail can serve such functions as the exchange of ideas, questions, and data. In addition, any kind of relevant course materials such as assignments can be attached to an e-mail message for easy submission.

An electronic mailing list makes mass distribution of an e-mail message an easy task. Instead of sending the same e-mail message to many users one by one, the message is sent to a list. Then, every member of the e-mail list receives the same message. An e-mail list is a suitable tool for WBI instructors for sending common interest items to students such as course announcements, reminders, additional web links to other useful web sites, and etc.

A treaded discussion group is a subject-related discussion in which participants post their messages in a central place. This central place could be a Bulletin Board System (BBS), Usenet newsgroup, or web forum. In this central place, users can read messages and respond to others' messages. Each new topic becomes a separate thread in the discussion. When someone reacts to someone else's message, it appears under the original one. In WBI, this structure can be used by students for topical discussion, assignment submission, social interaction, and collaborative working.

Chat provides a text-based conversation among multiple users. The text messages are seen immediately by all users. The conversation usually takes place in virtual chat rooms which reside on chat server software. Users connect to these chat servers by using a client chat software such as mIRC. Chat rooms can be used in WBI for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

An instant messaging tool is a convenient way to see when Internet friends are online and to message them in real time. It is faster than e-mail because the technology behind IM allows the message to be pushed to the receiver in a fraction of time, which can be said almost instantly. AOL Instant Messenger, MSN Messenger Service, and Yahoo! Messenger are examples of IM client software that can be used between Internet users. IM tools can be utilized in WBI for such instructional activities as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Audio conferencing allows two way voice communication via an Internet connection. With the help of a technology called Voice over Internet Protocol (VoIP), communication can be carried out between two different computers, between two different physical phones, or between a computer and a physical phone. In all of these methods, voice is converted to IP packets which travel through the Internet networks. Since the use of Internet is cheaper than the use of phone lines, audio conferencing is an economical solution to get WBI users together in an audio conference. In WBI, audio conferencing can be used for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Video conferencing requires the attachment of a small camcorder to the computer. With the help of this device a stream of audio and video can be transmitted over the Internet to the other users. The advantage of video conferencing over chat is the presence of live audio and picture of the participants of the communication. Video conferencing tools can be used in WBI for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Instructors and students have used these communication tools in practical WBI settings for various purposes. Branon and Essex (2001) found the reasons for using synchronous communication tools in web-based instruction environments as:

- Holding virtual office hours,
- Team decision-making,
- Brain-storming,
- Community building, and
- Dealing with technical issues.

They also stated the reasons for using asynchronous communication tools in such environments as:

- Encouraging in-depth, more thoughtful discussion,
- Communicating with temporally diverse students,
- Holding ongoing discussions where archiving is required, and
- Allowing all students to respond to a topic.

Their survey indicated that 35% of the distance educators planned to increase their use of synchronous tools, while 65% planned to increase the use of asynchronous tools. Just 5% of them planned to decrease the use of synchronous tools and only 3% planned to decrease the use of asynchronous tools. These numbers show that there will be a growing demand in the utilization of synchronous and asynchronous tools in WBI environments.

Classification of Internet Communication Tools

Since there are a number of WBI tools and technologies available, one of the most important challenge for the designers and instructors of distance courses is to identify the right tools for online learning (Levin, 1997). Dennison (2000) uses the properties of the tools to classify them into a taxonomy that shares one or more of the general properties. A taxonomy is an ordered hierarchical list. The parts of his taxonomy are:

- Number of people communicating: The communication can be individual-to-individual, individual-to-group, group-to-group, or group-to-individual.
- Real-time communication: The tools can be divided as asynchronous and asynchronous tools.
- Permanency of communication: The tools can be divided based upon whether messages on them are permanent or non-permanent.
- Automatic delivery of communication: The tools can be divided as to if the tool automatically delivers the message (pushing) or if the user must request for the message (pulling).

While the four properties above result in a possibility of 32 combinations, some of the combinations cannot have realistic tools. Dennison also stated that at the time of his writing, there were no tools for some of the combinations such as Individual-to-group, Permanent, and Push type. Example Internet communication tools for some of the categories are depicted in table 1.

Table 1. Taxonomy of Internet Communication Tools. Adapted from Dennison (2000).

Combination	**Internet Tools, Dennison (2000)**
Individual-to-individual, Synchronous, Permanent, Pull	CU-SeeMe
Individual-to-individual, Synchronous, Permanent, Push	Talk
Individual-to-individual, Asynchronous, Non-permanent, Pull	Voice mail
Individual-to-individual, Asynchronous, Non-permanent, Push	E-mail
Individual-to-individual, Asynchronous, Permanent, Push	E-mail
Individual-to-group, Synchronous, Permanent, Pull	IRC
Individual-to-group, Asynchronous, Non-permanent, Pull	Listservs WWW Usenet
Individual-to-group, Asynchronous, Non-permanent, Push	E-mail
Individual-to-group, Asynchronous, Permanent, Pull	Usenet
Individual-to-group, Asynchronous, Permanent, Push	E-mail
Individual-to-group, Permanent, Push	No tools in 2000

Problems with the Internet Communication Tools

In the literature, the current problems with tools that support WBI are found as (Harrison, 1997):

- Finding appropriate software for students and instructors,
- Access control to keep outsiders from disrupting class communication,
- Training students and instructors in the use of various software packages, and
- Cost of acquisition and use of appropriate tools.

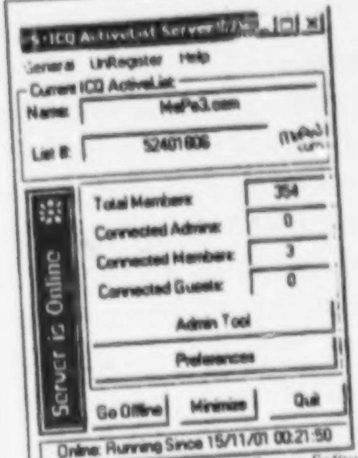
This paper describes ICQ Active List (ICQ AL), an Internet tool which can support a web-based distance education community by eliminating all of the problems stated above. It also discusses its strengths and weaknesses and presents strategies for creating a community for a WBI course.

ICQ and ICQ Active List

New forms of web tools are becoming available everyday. ICQ (I Seek You) is one of them, which is an integrated set of tools that informs who is on-line at any time and enables to contact them at will. Although it debuted as an IM tool with limited capabilities, users of ICQ can chat, send instant messages, files and URL's to others, or they just socialize with their Internet friends while connected to the Internet. All these functions are embedded into one easy to use client software.

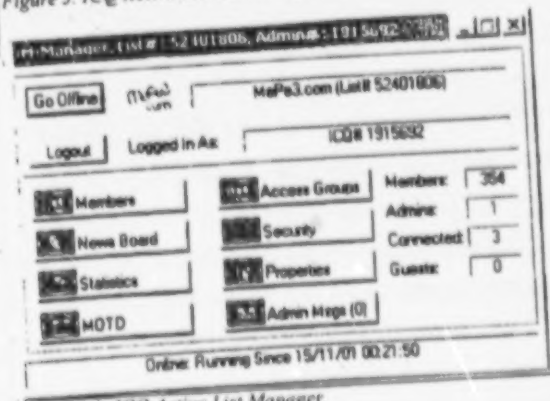
Version 99b of ICQ client comes with a new feature, the ICQ Active List (ICQ AL). Users can create or join ICQ communities based on a common interest and easily access them from their ICQ client software. Once users join an AL, they can broadcast messages to all of the members of the list, receive events from other list members, chat in a virtual room, post and view messages in a threaded discussion group, e-mail each other and view information.

Users can also become an AL owner, which gives them total control over the AL. They can delegate authority to any member of their list. In order to run an AL, Active List server software needs to be run. As long as the AL server software is running, the AL will be accessible by all ICQ clients. Figure 1, figure 2, and figure 3 show the interfaces of ICQ AL server, ICQ AL manager and ICQ client respectively. ICQ AL and ICQ client as an Internet tool for some of the categories of Dennison's taxonomy is shown in table 2.


ICQ ActiveList Server
General UnRegister Help
Current ICQ ActiveList
Server is Online
Admin Tool
Preferences
Go Offline
Minimize
Quit

Name: MePe3.com
List #: 52401806
Total Members: 354
Connected Admins: 0
Connected Members: 3
Connected Guests: 0
Online: Running Since 15/11/01 00:21:50

Figure 3. ICQ Active List Server Software


Manager, List # 52401806, Admin# : 1915692
Go Offline
Logout
Members
News Board
Statistics
MOTD
Access Groups
Security
Properties
Admin Msgs (0)

MePe3.com (List# 52401806)
Logged In As: ICQ# 1915692
Members: 354
Admins: 1
Connected: 3
Guests: 0
Online: Running Since 15/11/01 00:21:50

Figure 2. ICQ Active List Manager

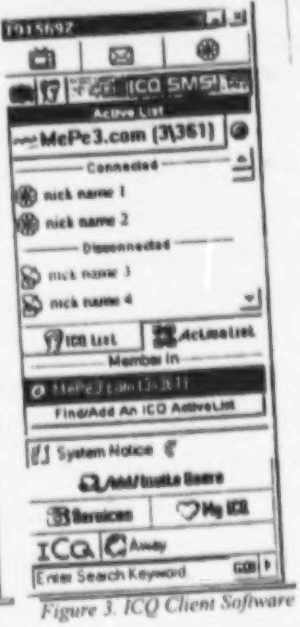

1915692
ICQ SMS
Active List
MePe3.com (3\361)
Connected
nick name 1
nick name 2
Disconnected
nick name 3
nick name 4
ICQ List
ActiveList
Member In
MePe3.com
Find/Add An ICQ ActiveList
System Notice
Add/Invite Users
Services
My ICQ
ICQ
Away
Enter Search Keyword
GO

Figure 3. ICQ Client Software

BEST COPY AVAILABLE

Table 2. ICQ Active List as an Internet Tool for the Different Categories of Dennison's Taxonomy.

Combination	Internet Tools
Individual-to-individual, Synchronous, Permanent, Pull	E-mail, chat, threaded discussion, instant message, audio conferencing, and video conferencing functions in ICQ AL and ICQ client
Individual-to-individual, Synchronous, Permanent, Push	
Individual-to-individual, Asynchronous, Non-permanent, Pull	
Individual-to-individual, Asynchronous, Non-permanent, Push	
Individual-to-individual, Asynchronous, Permanent, Push	
Individual-to-group, Synchronous, Permanent, Pull	
Individual-to-group, Asynchronous, Non-permanent, Pull	
Individual-to-group, Asynchronous, Non-permanent, Push	
Individual-to-group, Asynchronous, Permanent, Pull	
Individual-to-group, Asynchronous, Permanent, Push	
Individual-to-group, Permanent, Push	

Characteristics of the ICQ Active List

AL eliminates most of the problems of Internet communication tools depicted before. The most obvious advantage is that it is an appropriate tool for online communities and web-based courses. It includes many functions including email, threaded discussion, chat, instant messaging, audio conferencing, and video conferencing. It even includes a very useful feature called 'Message of the Day' (MOTD) through which you can make last minute or daily announcements. You can add a button and an Internet address (URL) as part of this message. As soon as the users are connected to the AL, the message is displayed to the user. User may click the button in the MOTD at will and visit the Web page associated with the message. AL integrates all of these functions into one easy to use interface; therefore users perceive all of the functions as a whole. They do not switch from application to application to perform different tasks.

AL works on all Windows platforms including Window NT, Windows 2000, Windows 98, and Windows 95. According to information presented at the counter.com web site, these 4 windows platforms cover 93% of all users in October 2001. Therefore, most of the Internet users are able to run AL on their operating systems.

AL provides a detailed security policy in which the administrator of the AL can define security at different levels. The administrator might authorize the members of the AL or members can auto join to the AL. When authorization is required, all potential participants must ask for authorization before joining to the AL community. The administrator might or might not publish AL information and online/offline status on ICQ AL directory listing. When it is not published, Internet users will not able to see your AL in the AL directory. In case of Internet security attacks, the administrator may ban specific IP addresses, therefore not allowing access to the AL from those IP addresses. The banning may be done at the user level also. When you ban a user, he/she will not be able to access to the AL. To make handling security easier for different people in the same AL, the administrator may create groups in the AL and assign rights to these groups. These rights can be assigned in terms of broadcasting, chatting, forums, and seeing information about the AL.

Both ICQ and ICQ AL come with detailed help files. However, help function needs to be installed separately for ICQ client. AL help includes such topics as introduction to AL server, registering an AL, components of the AL, operating the AL, and configuration. In addition to the help included with the ICQ client, ICQ Web site includes an extensive online help site at the following internet address:

- http://www.icq.com/support/

AL provides detailed statistics for each of the members. It provides details on when the user joined the community, when the user last logged on, how many times the user logged on to the AL, how many messages were posted by the user to the threaded discussion group, and how many messages were broadcasted by the user to the AL group (Sending a message to the AL is called broadcasting). You can also get such server statistics as the total logon times since the server was created, the maximum number of users who got online at the same time in the AL, total number of threaded discussion group messages, the maximum number of users who used the chat, and the number of users in the chat in real time. Additional statistics included are total members of the AL, number of connected members, guests, administrators, and online u[illegible]n real time. You can make an extensive analysis of the online community with the help of these data.

In any AL, administrative privileges can be shared by the owner of the AL with other members. This provides an opportunity to share the tasks related to the administration of the AL. Remote administrators can manage the AL server through their ICQ client, but before doing that the owner of the list should add these people to the administrators group.

You do not need to plan a budget for the use of this software, because both the AL server software and ICQ client are provided to the Internet community free of charge. The AL server software can be downloaded from:

- ftp://ftp.icq.com/pub/ICQ_Win95_98_NT4/ICQ2000a/ActiveList.exe

AL supports individualized messaging. Users of the AL can send a message only and only to the administrator of the group by using the 'Message Administrators' function. In this way they can ask questions about a specific issue that needs not to be known by the rest of the online community.

On the negative side is the fact that the AL server needs a continuous Internet connection to be active. The AL exists as long as the AL server software is run and connected to the Internet. If this does not happen, users will not be able to connect to the AL and the AL status will be offline to them.

Another problem might be in the support area. Since the software is offered free of charge, you can not contact the producer and request for a specific support. However, the help functions provided cover many of the issues, so this might not be a big problem.

It is not clear that the producer of the ICQ AL will continue to release new versions or the ICQ AL will be supported in the new releases of the ICQ client. However, the authors have operated an AL server for more than two years without an interruption. Besides, even if a new version of ICQ client is released which does not support AL, users may still use the old version of the ICQ client which supports AL. It was experienced that the oldest versions of the ICQ client software can still be run. The producer does not force the users to install the newest version of the ICQ client.

In terms of technical difficulties, there is a 400 member limit in the AL server. When this limit is arrived, no other people can join to the AL. The administrator should delete the non-active members to make list open to the new members. Most of the time, 400 member limit will be enough for most of the communities, especially if you are using AL for a Web-based course.

There is a policy set by the producer of the ICQ with the use of ICQ client. This policy states that ICQ service is not for use by children under 13 years of age. According to this policy, if it comes to company's attention through reliable means that a registered user is a child under 13 years of age, ICQ will cancel that user's account. Unfortunately, this may limit the creation of online communities, whose users are under the age of 13.

The Context of ICQ Active List in This Study

Kim (1998) proposed a model for creating online communities. Her model contains 9 principles, which she calls '9 Timeless Design Principles' for creating an online community. She built this model based on her experience with designing online communities for various clients. The principles in the model are helpful for addressing a number of social issues that everybody encounters when they create and administer an online community. The principals in this model are:

1. Define the purpose of the online community
2. Create distinct gathering places
3. Create member profiles
4. Promote effective leadership
5. Define a clear code of conduct
6. Organize events
7. Provide a range of roles such as visitors, new members, regular members, leaders, and etc.
8. Facilitate sub-groups
9. Integrate the online environment with the real world

Below is the description of how we applied these principles to create a sense of community.

1. Defining the Purpose of The Online Community

The purpose of an online community can be as general as bringing users together for a general discussion on a topic of interest. It can also be as specific as answering a question. In our case, we chose 'music' as a general topic. Members of the community have used the AL to discuss different genres, artists and music albums, to make comments on these, to share new services and Web sites related to the topic, and to socialize.

2. Creating Distinct Gathering Places

As soon as you run the ICQ AL server and connect it to the Internet, you have a virtual place on the Internet for your community to get together. Within the ICQ AL server itself, chat room functions as an extra unique place to gather. There is an indicator on the interface of the ICQ client, which shows the number of the people in the ICQ AL chat room. If members see any number here, they know that there are people in the chat room, and they can go there to get together. Even if there is nobody in the chat room, they may go to the chat room and wait for someone.

3. Creating Member Profiles

Every Internet user needs to create an account to use the ICQ client. During the creation of this account, the user might provide a wide range of personal information including name, nick name, e-mail addresses, postal address, gender, age, Internet homepage, occupation, position, interests, affiliations, phone numbers and a picture. Providing some or all of this information is up to the users. They may update their profile anytime by using their ICQ client. Since this profile information is provided by the members, administrators do not need to enter this information for each new member of the community. ICQ AL software associates the personal information provided by the members with the user accounts in ICQ AL server. Therefore, the administrators and other members can easily get information about the members of the community by using this feature.

4. Promoting Effective Leadership

During our experiences, it turned out that creating a community is just one side of the coin. After the creation, you need to identify strategies that will foster communication in the online community. Otherwise, the communication will not go beyond simple greeting messages. You would be even lucky if someone would respond to those greetings. Whatever tool you use, either chat, threaded discussion, or instant messaging, someone or a group of members need to take the initiative to make the communication ongoing. Kim (1998) examples this by using the land metaphor. You can purchase a piece of land, but it will not automatically turn into a nice garden. You need to know your needs, 'sow the seeds at the right time, manage the growth, defend against attacks, and be prepared to improvise'.

5. Defining a Clear Code of Conduct

Within the ICQ AL server, the properties of the AL server may be described with a short description and long description. hort description is useful for informing people in the AL directory. Long description may be used to define the code of the conduct for the community. In this area, we have defined rules to follow for the members of the community. As part of these rules, we defined actions for inappropriate behavior. For example, if a member has a bad mouth in the community, he is banned and he can not access to the community for a period of time. New rules had to be defined as the community grew and the number of interactions increased. For example, we recommended members not to accept any type of files from members that they did not know. We also made the code of conduct available on a Web site for the community.

6. Organizing Events

We organized several events in our online community. A backgammon tournament was one of them. The administrators made an analysis of available tools for this purpose. Most of the time, new tools are required to organize such events. Therefore, emphasize should be put on those tools that the members of the community will be able to use with minimum effort and resources. An innovative 3D world might sound good at first, but you need to make sure that every member of the community will have access to such a tool. It was observed that this kind of activities made the members who participated in the activities closer to each other, just like in the real world. This kind of members interacted among themselves more often and less formally.

7. Providing a Range of Roles

Some of the roles are already defined when you run your AL. These roles are administrator roles, new member roles, and guest roles. We defined regular member roles in addition to this. Administrators are responsible for the administration of the AL, like running the AL, adding and removing the members, maintaining the member database, and etc. By default, every new member of the community is assigned to new member role. This makes other members differentiate between new members and regular members. Guest role was disabled since we wanted every participant of the community to be a member of the community. Regular member role was given to those members who regularly logged on, broadcasted messages, posted messages in threaded discussion group, and participated in the chat room. Up to 4 icons can be used to differentiate the members in different roles. The function of these icons is very important. By looking at the icon of a member, another member can easily recognize the role of the other member just like identifying social status of a person by looking at him in the real world.

8. Facilitating Sub-Groups

We experienced that after a while, some of the members would like to focus on specific sub-topics of the main topic. For example, in the threaded discussion group, different threads have emerged in time. These threads included such sub-topics as the properties of a quality guitar, exchange of music hardware, comments on a particular song, and etc. We experienced that threaded discussion tool serves a good function towards this principle.

9. Integrating the Online Environment with the Real World

Since most of the members of our community are scattered around the world, it is almost impossible to gt together physically with the members of the community. However, audio and video conferencing technologies may help closing the gap between the virtual world and the physical world. In today's computers nearly every computer comes with a sound card. When you have a sound card in your computer, you can use a software called NetMeeting to make voice conversation between 2 different computers connected to the Internet. ICQ client successfully integrated NetMeeting into its own structure. A member may just select another member in the list and initiate a voice conversation. Then, NetMeeting starts and the connection is established between the remote computers. In our community, we have made many successful voice conversations between different locations as far as 10000 miles from each other. Most of the time the quality and pace of the conversation was not very different from a phone conversation. NetMeeting also supports video conferencing. However, almost none of the members had a camcorder required to conduct a video conferencing.

External Evaluation

We have examined some external evaluation data related to the ICQ AL. Download.com is a Web site that distributes software. On this site, Users may also submit their opinions about various software they use by rating the features, usability, and stability of the software between bad and excellent. They may also add their additional comments. As of November 2001, 69% of the users recommended ICQ AL to be used by others (109 votes). Features, usability, and stability were all rated as 4, which meant good in the range.

Some of the users made useful qualitative comments. One of the users, who was positive, identified the software as very nice. He gave some technical information on his usage and indicated that he ran several AL servers flawlessly on a computer with a Pentium 133 MHz processor and 32 MB RAM.

Another user made a very interesting comment. He indicated that his AL server was running smoothly all the time with no problems. He commented that:

> *The downfall of ICQ [AL] is its best feature. It has tons of options. You just have to be smart enough to use them. If you are afraid of your programs or you don't play with them, then you will never get it right.*

Discussion and Conclusions

We have used the principles identified by Kim (1998) successfully to create an online community on the Internet. This study is still in progress and every new day might result in a different experience. If you can successfully follow the 9 principles in the creation of your online community, most of the time members of your community will swing between the virtual world and the actual world just like a pendulum swinging between two different points on a continuum.

ICQ Active List is a suitable and efficient tool in creating an online community. And you can use this tool to create learning communities for your Web-based courses. However, just like any other tool, you need to use components of this tool at the right time, right place, and with appropriate strategies. Providing gathering places, defining the rules, organizing events, providing roles, and facilitating sub-groups are useful strategies that can give your online community a character. However, they are not enough to complete the recipe. If you top off these with effective leadership then you will have an effective and functional community. Our experience showed us that, most of the people in online communities are still not used to the freedom Internet has offered. They still need leaders who will guide them.

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WEB-BASED INSTRUCTION:INSTRUCTOR AND STUDENT PROBLEMS

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Abstract

In this study instructor and student problems related to the Web-Based Instruction (WBI) were identified after examining their experiences. Interviewing technique was used to collect data. Semi-structured interview questions were asked in order to identify problems related to the design, technology, support, management, student-centered learning, communication, and time from the perspectives of students and instructors. Instructors' problems were found in the area of support, communication with students, providing feedback, and handling the number of students. Students' problems were found in the area of learning new tools, communication with classmates and instructors, and social aspects of learning. Results indicated that meeting at least once face-to-face before the course and providing environment for an effective communication were important parameters for formalizing the interaction between students and instructors and also among the students. In addition to this, it is also found that fostering dialog, participation, and interaction, formative assessment of assignments, increasing students' motivation, giving importance to student differences in learning, using active learning techniques, and designing effective web sites will increase the success of the WBI.

Introduction

Using the Internet for different purposes has entered a revolution to provide better communication among people during last two decades. Especially, after the development of the hyperlink on the World Wide Web (WWW), the Internet has offered more user-friendly environments (Starr, 1997). Researchers indicated that WWW is not only a communication medium for e-mail and document distribution but it is also a place to learn (Lightfoot, 1999; Mioduser, Nachmias, Lahav, & Oren, 2000). With the combination of the specifically designed software and pedagogical knowledge, WWW can provide an educational environment that maintains the knowledge building approach to learning. These understanding, technological developments in communication and WWW have been used as new opportunities for delivering instruction online. Thus, distance learning has emerged as an approach to education in the last few years (Yellen, 1998). Especially for graduate students, universities have started to offer their courses online (Barnard, 1997; Duchastel, 1997; Kearsley, Lynch, & Wizer, 1995). These practices in new educational agenda initiated some questions on researchers' mind. They started to identify how effectively online teaching has been delivered. According to Duchastel (1997), WWW have been used mostly to support the traditional model of university instruction. This approach resulted in the loss of potential of Web tools in teaching. To use the Web effectively in instruction, instruction should be transferred to Web totally and given by using web-based teaching approaches and technologies. Moreover, Duchastel (1997) also argued that models for transferring instruction to Web have not been determined definitely.

In addition to ways of delivering instruction online, researchers have also started to investigate the characteristics of online teaching, which affect the success of distance teaching (McIsaac, Murphy, Games, & Igoe, 1989; Pisik, 1997; & Trentin, 1997). McIsaac, et al. (1989) reviewed 62 articles and found that researchers have carried out their studies mainly on two broad categories: instruction and administration. Under the instruction category, researchers studied learning, attitude and dropout. Under the administration category, cost-effectiveness and courseware design were investigated. According to these researchers these two main categories and subcategories are the main characteristics of online teaching. It is emphasized that these characteristics should be considered carefully during design and delivery of the online courses.

Berge (1997) explored how teachers design and deliver online instruction for adults in a post secondary school. It was found that student-centered learning, self-reflection, discussion, collaboration, authentic learning, and online discussion are the most important characteristics of the online teaching. These parameters determine the success of the online teaching. According to Sheffield (1997) learner characteristics and the instructional strategies such as selecting and sequencing events and contents are the most important parameters in online teaching. Since the learners' characteristics impact the choice of instructional strategies and the subject matter of the course, instructors need to consider the diversity among the students. As opposed to traditional classroom, online classrooms combine the students whose cultural backgrounds are very different from each other. Teaching multicultural group is an inevitable aspect of the online instruction. Even though the parameters that affect the success of online teaching have been investigated from different perspectives, teaching through online courses created different problems for students and instructors. Lui and Thompson (1999) investigated how teaching simultaneously the same course in both a distance and a traditional educational format affects instructors and what the differences are between the two teaching styles. It was found that even though the instructor prepared the same teaching materials for distance and traditional classes, preparation of distance course materials were more time consuming than traditional one. Moreover, time management, monitoring students, and e-mail communication also took most of the instructor's time to provide effective teaching to distance students. In addition to instructors' problems, researchers have investigated the students' perspectives in comparing traditional teaching and online teaching. Results indicated that there are some advantages and disadvantages of learning online. In terms of advantages, students indicated that they have wait time before answering the questions or responding to the situations. In traditional classroom they were expected to give answer right after the questions are asked. In addition, they believed that with online teaching learning goes deeper and broader. There is no time constraint. They can study 24 hours a day. In terms of disadvantages, they found that the text-based communication creates a sense of isolation, misunderstanding, suspicion, and a lack of credibility (Herman, 1999 & Mory, Gambill, & Browning, 1998). In addition to these problems, Wulf, & Schinzel (1998) investigated the effectiveness of videoconferencing, telelecture, and telelearning. It was found that videoconferencing is not sufficient in quality transmission, telelecture reduces the students' attention and interactivity, and telelearning requires new effective instructional tools. Ozden & Cagiltay (2000) found that lecturing technique should not be preferred as an instructional method in WBI.

In this study, we explored WBI problems from two different approaches that are different from the previous studies. First, in the literature, it is observed that researchers investigated instructors' and students' problems separately. Those problems mostly related to one type of Web-based course and participants explained their problems related to that course. In other words, in each study, researchers concentrated on a single Web-based course and problems associated with that course from the students' or instructors' perspectives. With this study, we aimed to identify the problems associated with different Web-based courses and from both students' and instructors' perspectives in order to provide a more detailed and two sided information. Besides, we identified that problems related with support, learning new tools, feedback, class discussions, and group projects have not been identified in detail. We considered that these are very important characteristics of WBI and should be investigated thoroughly.

Methodology

Participants

In this study, two instructors and two graduate students from a large mid-western university were interviewed. Participants from both the instructor and the student groups were selected with purposeful sampling. Since the nature of this study is qualitative, participants were selected according to their previous experience with the WBI to get deep and broad understanding about their problems related to WBI. It was required for the instructor participants to teach at least one Web-based course and it was required for the student participants to take at least one Web-based course. Instructors and students were the members of the same university, but none of the participants had a relationship through the courses.

Both of the students were graduate students. They were doctoral students in science education department. They held full-time jobs as an Assistant Instructor (AI) at the same university. Both of them were comfortable with using the computers and the Internet both in their courses and in their daily lives.

Instructor1 was a non-native speaker of English and he was an AI in the Informatics department. He taught a Web-based course three years ago. The students took this course within another country while the instructor was in US.

Instructor2 was a native speaker of English and she was a faculty in an Instructional Systems Technology (IST) department. She had already finished the first nine weeks of her Web-based course when the interview was conducted. The students who took this course were the online master students and they were seeking for a master degree through a distance master program in an IST department.

Web-Based Courses

Student1 took a Web-based course as an elective, which was given in a semester. The main objective of the course was to teach the ways of using the Internet in K-12 schools. There was one instructor teaching the course.

Student2 took a Web-based course as an elective for her major in science education department. The course was offered in six weeks during the summer session. The purpose of the course was to teach incorporating technology into the instruction. There was one instructor teaching the course.

Instructor1 taught a course in which the purpose was to teach courseware design for computer mediated learning. The course was at the graduate level and 10 students took the course. The course was offered in an instructional technology department. There was another instructor for the course.

Instructor2 taught 2 courses. One of the courses aimed to provide an introduction to the field and profession of instructional technology. The other course provided information on the instructional design process. Both courses were at the graduate level and they were part of an online master's program. The courses were offered in an instructional technology department. There were 1 instructor and 10 students in the first course, 2 instructors and 18 students in the other course.

Data Collection

Semi-structured interview questions were used to collect interview data. Interviews were conducted over a one month period. Each interview session was treated as an individually constructed discourse between the researchers and the participant. Both open ended and probing questions were used to get deep information for categories determined before the interviews. Main categories included problems related to design, technology, support, management, student-centered learning, communication, and time. In addition to these categories four open-ended questions were asked independently to compare classroom teaching and online teaching. The questions for the instructors were:

- Which one is difficult classroom teaching or online teaching?
- Do you feel like facilitator or instructor?

And the questions for the students were:

- Which one is difficult, classroom learning or online learning?
- Do you like student-centered learning?

Data Analysis

The study called for an in-depth understanding of the experiences of participants involved in WBI. Instructors' and students' data were analyzed separately from each other. All data were transcribed from audiotapes for analysis. Then, researchers struggled to understand the context, discourse, and meaning behind the participant responses to determine the main areas about which respondents have problems with WBI. It was observed that participants did not have problems about some of the pre-determined categories. New categories for instructors were determined as support, communication with students, providing feedback, and handling the number of students. New categories for students were determined as learning new tools, communication with classmates and instructors, and social aspects of learning from students' perspectives. To increase the credibility of the study, participants' responses were coded by both researchers separately. Later, common themes accepted as the new emergent categories. In addition, the data obtained from the literature was used for detailed interpretation of the results.

Findings

Interview results with students and instructors will be presented under miscellaneous categories. First, instructors' problems while teaching Web-based courses will be presented. Then students' problems will be explained in detail. Finally, we will provide instructors' and students' preference in terms of classroom instruction or WBI.

1. Instructors' Problems with WBI

Instructors' problems and difficulties will be summarized in the following categories: Support, communication with students, providing feedback, and number of students.

1.1. Support

Feeling lonely and finding support when they are in need are the biggest problems for the instructors. Since they do not know what kind of problems they will have during the course, it is difficult for them to be prepared against these problems in advance. When they have problems, instructors need two types of support: technological support and design support for the revision of the course web site. If they do not have both kind of support on time, they spend most of their time to overcome these difficulties instead of preparing themselves for future instructions. Instructor2 indicated that she was not able to have a Macintosh computer (which she was used to using) and required software at the beginning. Because of the lack of technological support, she had a lot of communication problems with the students. She had to provide feedback much later than her planned time frame. She explained the design problems as the following:

> *Instructor2: ... The other big and huge problem was the sound in PowerPoint. ...So, you can go through the whole week then look how to fix it. That has been very time consuming for me. Probably more time consuming than any other thing that I have done for the course. I have been doing the redesign of the web pages and then going through and editing the lessons, [and] the visual parts of the lesson.*

Learning new software also creates problems for instructors if they learn them while giving Web-based courses. They need support from the people who know these software.

> *Researcher: How about learning new software?*
>
> *Instructor2: Yes, because I had to learn Dreamweaver and I did not have the application, so I needed to track down getting the application from one of my friends. Even though the documentation was written, it was brand new program for me. Thankfully one of my friends came in, and spent about 15 minutes with me kind of showing the basics to me.*

1.2. Communication with students

Having students involved in class discussions is really important for instructors to grasp an idea about student improvement, student learning, and student problems. However, both of the instructors indicated that having students involved in class discussions is not an easy task. Since most of the students prefer to study alone, they hardly respond to class discussions. In addition to the lack of participation in class discussions, most of them also do not send any response to their instructors.

> *Instructor2: Students are very intentional about their own learning. They are doing it and I think they would like to see more of it because they are kind of doing it on their own. ...In fact, there has not been very much interaction between them even though there has been a kind of mechanism for them to have some discussion. They do not respond to each other a lot. They are supposed to put these smaller type assignments up and comment on each others'. They are pretty good about putting up their own work, but only 2 or 3 students have consistently been commenting back to each other. And, many students never made any comment to anybody else. So there is not a lot of interaction going on in the course.*

Face to face communication is also necessary for WBI. Both of the instructors think that knowing students personally is important to get feedback. Talking to person without knowing puts distance between the two people. Both of the instructors felt this distance between them and their students. Instructor1 indicated that he lost one or two of the students during instruction. He believed that if he did a face-to-face talk with these students, he would be more helpful for them to solve their problems and make them believe not to drop the course. Instructor2 indicated the importance of the face-to-face interaction as:

> *Instructor2: I think one thing in distance environment that is different from our typical face-to-face courses is the informal interaction that often takes place either in the classroom or as they walk by in the hall. ...So, it is like there are some interactions [in web-based courses] that are missing.*

1.3. Providing Feedback

Instructors provide feedback to students' questions and assignments. Students ask their questions basically by sending e-mails. Any given day, instructors have lots of e-mails related to students' problems. Responding to each e-mail message on time is really time consuming for instructors and sometimes it is frustrating. Instructors feel pressure to check their e-mails very often because they believe the importance of timely feedback. Instructor1 indicated that students were expecting an immediate feedback from their instructor. Otherwise, the students believe that the instructor does not give importance to their e-mails. This feeling affects the students' performance. To prevent any negative student opinions, instructor2 tries to check her e-mail every hour and try to respond to them immediately. If the questions need detailed answers and the instructor does not have enough time to write long e-mails, she prefers to send a short e-mail to confirm the reception of the message and responds in detail later. Since all of the students in instructor1's class were taking the course from a different country, he changed his daily and nightly schedule according to students' time. He did not sleep until 4 am to provide feedback.

Grading students' assignments and providing feedback are also difficult duties for the course instructors. Instructor2 explains her opinions about this issue as:

> *Researcher: Are you having any feedback problems?*
>
> *Instructor2: Yes, just getting it done. I have a nightmare last night. I feel terrible about that. Because I feel timely feedback is important. So, not to have the feedback within reasonable time, like a week turnaround, bothers me a great deal. I literally had nightmares all last night thinking. I kept up waking up to see if I have got the feedback. So it bothers me a lot and it bothers them a lot. They keep asking "when you are gonna get things graded". So, it is definitely an issue in [Distance Education] class.*

Instructor2 also indicated that she did not feel comfortable even though she graded and returned student assignments on time because she felt that some of the students were suffering from silence. She expected the students would reflect their ideas about their grades. Some of the students did so. But some of the students preferred to remain silent. She really wanted to get response from each student to make sure that they were happy with their grades.

Both of the instructors agreed that the hours spent for a three-credit course is more than a face-to-face course. Instructor2 emphasized the hard work she put with the following phrase:

> *Instructor2: I really do work 16 hours a day and 7 days a week and every day since school started.*

1.4. Number of Students

Instructors argued that number of students is important to provide effective instruction to them. According to the instructors, 10 to 15 students is ideal class size for WBI. Instructor2 hired an additional graduate assistant to grade students' assignments on time. She felt that otherwise she would not be able to finish grading students' assignments.

2. Students' Problems with WBI

Interview results indicated that students have wide range of difficulties while taking Web-based courses. In this paper, students' problems and difficulties are summarized under the following categories: learning new tools-novelty effect, communication with classmates and instructors (class discussions, group projects, and feedback), and isolated learning.

2.1. Learning New Tools: Novelty Effect

Both of the students indicated that they had to learn new tools such as software, uploading files, chat communication through Oncourse or Sitescape, and etc. These new tools were not easy for them to learn at first when they were introduced to the online environment. Learning a new way of communication has created chaos at first, but in time students got used to it. However, learning to use new software to finish projects was really painful for students. It takes time and extra effort to learn new software. Students believe that during this process, face-to-face instruction is necessary to increase their effectiveness of doing their project. One of the students indicated that software learning was not part of the instruction. Instructor of the course expected from students to learn different software to do their assignments. However, learning new software and application of this knowledge to the assignments are not easy for a student if he/she is taking the course online. At first, students feel lonely and confused a little bit in finding resources or people who can help on that. Sending e-mail to the instructors to learn the new software is not the best solution at this point. The following part of the interview depicts the second student's problems with learning new software:

> *Researcher: What about software?*
>
> *Student2: Yes, so I had to learn a lot of programs with that. Flash... I had to do some video editing. Dreamweaver... so I had learned them on my own. I got some help at the technology lab.*
>
> *Researcher: You told that you had to learn Flash and you got help from a center. How was that help? Was it related to the course? Was it part of the course?*
>
> *Student2: It was external. You are bringing up a good point; it would be more helpful if there was a help center in our faculty. They just expected us we had to learn this stuff. Not a student, but someone else told me about technology center... I still feel guilty going there. I felt bad asking them questions, because I really thought my course should have been setup to help the students. I would give my ideas.*

One of the students also indicated that trying to learn new software is scary at first, even though accomplishing this task was not difficult.

> *Researcher: What about learning new software?*

> *Student1: I had to learn how to use notepad to do my html. I had not used notepad before. So, I think it was assumed that everybody had used notepad before, and I was like what do I do? So I had to figure that out on my own and it turned to be really easy but it was a little scary at first, like just trying to use something for the first time.*

2.2. Communication with Classmates and Instructors

Class discussions, group projects, and feedback are the main way of communication for students to share their ideas with their classmates and instructors. In this part, problems with class discussions, group projects, and feedback will be given in three different categories.

2.2.1 Class Discussions

During the class discussion, since most of the students actively participating in the discussion ask their questions at the same time, students have difficulty in following the flow of the discussion. In time, they get bored and quit writing their responses and asking questions. It is very difficult for students and instructors to create an environment helpful for their learning and teaching.

> *Student1: … And then when we used the live chat, which happened through Oncourse, somebody would post a comment and all of us would respond to it. But it took so much time to response to a post, in the meanwhile another response would come up, we could lose the chain of conservation because everybody was seemed to be engaged with a bunch of different conversations, it did not flow. Like, you say something, I say something, and he says something. There were all postings out of sequence. So, that was frustrating. We even talked about in the discussion like "woo I cannot track of this" you know, too many people are saying too many things at once.*

In addition to this chaos, the students also indicated that time issue was problematic for the communication. Generally, since there is no meeting time for WBI like in face-to-face instruction, students study at their own pace and respond to the activities according to their available time. Some of the students prefer to study during night and some of them prefer to study during the day. These working schedules create difficulty in finding common time for class discussions. Due to these problems, some of the students prefer not to attend to class discussions. Interestingly, in this study, both of the students indicated that they did not have a computer at home. They have used the university's computers. For some class discussions, one of the students needed to go to school without considering the time.

> *Student1: Several students could not make the live chat sessions. We tried to schedule the live chat and it was very difficult to get a good time. We ended up making it very late; actually I had to go up to the school at night, sit around and do this thing.*

Because of having difficulties in following the chat and finding a suitable time for the chat sessions, students think that class discussions are not helpful for their learning.

> *Student1: There really was not a lot of discussion. It almost seemed like because the discussion was so awkward and unnatural compared to just face-to-face interaction, I almost fell a desire to just do the course independently, like do it myself.*

2.2.2. Group Projects

The main problem in doing group projects is to communicate effectively with the group members. Since the main communication method is e-mail, it is difficult to respond to the e-mail messages immediately after they are received. Delay in e-mail response time makes the partners frustrated and they perceive it as the waste of time. Students believe that face-to-face communication during group projects helps them to find quick solutions to their problems and ask questions and have answers directly without a delay.

> *Student1: … I am always checking and replying. That's [e-mail] like a primary form of communication for you. And for a lot of other classmates, it is not. It was frustrating for me to send an e-mail and not getting immediate response or at least getting a response that day. To not hear from the people for two days after I send them e-mail when I am supposed to working with them on something. So, I kind of felt like waitingggg. Hellooo. Like, answer my e-mail. So that was frustrating.*

Since students do not want to take other persons' time, they try to check their e-mail more often than they do usually. Students feel pressure on themselves to check their e-mail whenever they find time and a computer. Because of this pressure, even though they do not want to think anything about the course, they force themselves to check their e-mail and respond to them accordingly. They feel like they have to work on their group members' schedule and not their own schedule. In time, the course becomes a part of their daily life.

> *Student2: … Just like in meeting, you have that time you know you can ask these questions, and talk about things. When you do not have these meetings the question is always going on. I do not like that as much… And you know some weekends, I do not have to think about the course but I get e-mails from people and you cannot always work the same schedule with someone else.*

2.2.3. Feedback

Students usually take their feedback from instructors and classmates during courses. For WBI, students feel like responses and feedback from classmates are not as informative for them. Students have difficulty in giving credibility to classmates' opinions. Student1 indicated difficulty in trusting people if she does not know them. Because of this reason, she gave importance to instructors' feedback rather than classmates' feedback. In addition to that, student2 emphasized that most of the students did not have enough time to spend for other persons' problems. Instead, they are spending their time to find solutions to their own problems. This belief also decreases the effectiveness of the communication among the students. Students perceive the course instructor as the only resource to get information and to find answers to their questions. However, thinking like that is not the solution for students' problems. Students do not feel free to ask questions to the instructors at any time. Instructors post a time limit for students on when they should expect a response. Student2 felt herself guilty when she sent an e-mail outside of this time limit because she thought that she was taking instructor's time and disturbing him.

In face-to-face communication it is easy for instructors to follow their students' learning and provide feedback when it is necessary. In WBI, instructors can do so only if students send e-mails or responds to classroom discussion. Most of the time, this situation creates problems for doing assignments. Students want instructor feedback when they work on their assignments or projects. For WBI, students are expected to send their final version of projects. Both student1 and student2 felt that they did not get any feedback for their studies during their work. Also, their instructors did not return their final projects with the feedback. They thought that this way of grading and submission was not helpful for their learning. Since they did not know their strengths and weaknesses, they were not sure whether they were successful or not on achieving course objectives. This situation is more problematic for students who are not comfortable with asking questions to instructors to get feedback for their assignments. Sending everything on due date and having nothing but the grade makes students frustrated.

> *Student2: ...because you could not ask clarification questions. We were not able to ask [like in traditional class] for her to say "oh you make sure you do this part of the assignment." It was a huge project that was hard to imagine the entire time that was involved. It would have been nice if it had little check points on the web like "oh you need to turn this part" instead of it was like everything was due at the end.*
>
> *Student1: I would like to get more feedback along the way I was doing my project. Like creating my web page. I would like to be able to submit it, get some feedback then go back and change it. Improve it and be graded on it. Whereas we submitted it, we read everybody's comment and got a grade. A big part of the grade was coming from this project.*

2.3. Isolated Learning

Doing collaborative work or group projects in WBI is difficult for students. Because of the difficulty in finding time for group work and giving importance to just instructors' feedback make students isolated during the course taking. The primary reason for students to take WBI is the time flexibility. They do not have to be in the classroom at certain times. So, they can take these courses when they work. This is another reason for the isolation of students from collaborative work.

> *Student1: I like to work with groups sometimes. It depends on if your schedules can match up like in face-to-face classes. With this one, I am glad that we had individual assignments versus group assignments. I think group assignments would be way too difficult to coordinate because people are online at different times. I would do my things during the week and then not online during the weekend. So, there are a lot of people doing it (classroom teachers) at the weekend. So, we always missed each other.*

In face-to-face communication students have a chance to get to know each other and to develop trust for their classmates. Student1 indicated that since she did not know the people, it was hard for her to develop trust for them. Students do not care about other students' learning, ideas, and difficulties. Their purpose is to finish the course at their own pace. They do not want anyone to disturb their comfort. Student2 said that she had a difficulty in learning different software such as Flash. However, she did not request for help from anybody in her class. She thought that everybody should have spent their time for their assignments. They did not have time to teach Flash to any other classmate. In her opinion, it was the instructor's responsibility to help students with learning new software. When she asked for help to this problem from her instructor, the instructor sent an informative web site. However, she had difficulty in finding answers to her questions. Finally, she decided to find an external support for her problems. She further indicated that too much student-centered learning makes students isolated. There should be more instruction and guidance provided by instructors. Interestingly, student2 also felt that her instructor was isolated and her teaching style was also an isolated type.

> *Researcher: Do you think it is the duty of the instructor to find solutions to your problems?*
>
> *Student2: Yes, what was she doing? I do not know what she did all semester. It bugged me. I did not see her taking time out to organize anything. It is obvious to me that there should have been help sessions.*

According to students, instructors are not aware of students' problems. Sometimes as the result of the student e-mails, instructors are informed about the problems. In most cases instructors send information such as a useful web site or a detailed e-mail message to help students. However, students indicate that some of the problems are difficult to solve with these information. Students still have questions in their minds and reading information through web sites or through e-mail still do not answer their questions. They need face-to-face interaction with instructors not only for asking questions but also for discussing the ideas related to their problems and for getting immediate help.

3. Responses to Open Ended Questions

At the end of each interview session, two questions were asked to identify instructor and student preferences for classroom instruction and WBI.

3.1. Which One is Difficult Classroom Teaching or Online Teaching?

There are some advantages and disadvantages for classroom and Web-based teaching. Because of this, instructors had difficulty in choosing just one type.

> *Instructor2...because it (WBI) is new and because it is unfamiliar both to instructors and learners, it is harder and more time consuming. So if someone says I could teach either way, I would probably choose the classroom, because I know how it is done, the students know how it is done. I can do it more quickly and easily. But that isn't to say that I do not think there is good place for online learning. I actually think that there is and I think it allows us just to do things and have opportunities that we could not have otherwise. But I think face-to-face is definitely easier. It is easier to prepare for; it is easier to deal with every way. The other is just more time consuming [for the instructor].*

3.2. Which One is Difficult Classroom Learning or Online Learning?

Even though student1 had positive and negative ideas about both, student2 definitely preferred the classroom teaching.

> *Student1: I think it depends on the subject matter. Our class dealt with the Internet itself. It was appropriate in a way. But I could imagine if we were doing something like teaching methods class, then it would have been ridiculous to try to do that online. I think for some courses you have to interact face-to-face with other people and actively do versus doing on your own and submitting.*
>
> *Student2: I think learning online is more difficult. If you are in the classroom, teacher is talking so you know what information is important or what you need to know, whereas on the web it is just like there is so much stuff that sometimes it is hard to know what is the most important thing. Are they all important?*

3.3. Do You Feel Like a Facilitator or Instructor?

Both of the instructors felt themselves as a facilitator.

3.4. Do You Like Student-Centered Learning?

Student2 indicated that student centered learning isolated students and make learning more individual. Student1 liked the individual learning since it provides her to arrange her daily schedule according to other tasks.

> *Students2: It was too student centered. I think that can be bad, really bad because it makes you isolated, you need to have a little bit more instruction, or guidance.*

Conclusions and Recommendations

In general, both students and instructors have problems on similar issues such as communication, feedback, and support. It is clear that solving problems of instructors might be helpful in solving students' problems or vice versa. For any Web-based class, face-to-face interaction should be held at least once at the beginning of the course to help instructors and students to get to know each other. Since the technology is developing very fast and making the hardware and software cheaper, Web-based video conferencing can be an option for those who cannot attend face-to-face interaction.

For instructors, technological support should be provided on time and when it is needed. Computers and software are the only way to communicate with students. If instructors have difficulty in obtaining this support on time, their communication with students can be disastrous. Students can easily drop the course just because of this.

Application of different instructional methods can be helpful for increasing students' motivation and interest toward WBI. In addition to this, spending time for preparing instructional materials by considering differences in learning style and diversity in class can make students think that their instructors are spending time for teaching the course. Since the time spent for solving course problems by instructors is invisible to students, they think that their instructors are doing nothing to help them in their learning. In face-to-face teaching, instructors give importance to apply different teaching methods according to students' difficulties. Application of the same strategy in WBI would be helpful for both instructors and students.

Formative assessment is another missing part in WBI. According to Buchanan (1999), feedback given as in the form of continuous formative assessment might help students to monitor and evaluate their progress. At the same time, this approach can help instructors to see the students' difficulties and provide immediate feedback when it is necessary. Another benefit of the formative assessment might be increasing the communication between instructor and students.

In face-to-face classroom, instructors have advantages in understanding students' difficulties while observing them in classroom. In online teaching, there is no chance for instructors to do this. However, instructors can do this observation by sending e-mails to students to learn their difficulties instead of waiting e-mails from them. Some of the students can prefer to stay silence in WBI but instructors' e-mails can make them feel that their instructors are taking care of their progress and difficulties. This approach can also be helpful in preventing student dropout.

To foster dialog, participation, and interaction, instructors need to find activities to increase students' involvement in group working and discussions.

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An Empirical Comparison Of Navigation Effect Of Pull-Down Menu Style On The World Wide Web

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Abstract

As the popularity and accessibility of the World Wide Web (Web) increases for shopping, effective navigation is becoming more and more critical to the success of E-commerce. Even though many educational technologists and Web designers have spent their energy developing effective navigation tools, it remains difficult to develop Web systems that can help customers find products or services that thy wan to purchase without experiencing disorientation problems and cognitive overload. Many E-commerce Web sites are beginning to employ a pull-down menu since it provides the most versatile navigation mechanism. Although the pull-down menu design has been used in other computer applications it is relatively new on the Web. This study analyzed the navigation effect of the pull-down menu design with three hierarchical information structures (constant, increasing, and decreasing types). The navigation effect was measured by two information searching strategies (searching and browsing) and three users attitudinal measures (appeal, perceived usability, and perceived disorientation). Three Cyber-shopping malls were developed with the pull-down menu design and three information structures. Fifty-eight undergraduate and graduate at mid-western university participated voluntarily in this study.

The findings provide useful information for designing a pull-down menu design and information structure for effective navigation. The results of this study show that there exist better combinations of pull-down menu design and information structures in terms of the efficacy of browsing, the overall appeal of the site, the perceived usability and the users perceived disorientation. The overall results showed that decreasing information structure produced more effective browsing speed, appeal, perceived usability, and disorientation than increasing information structure. This study demonstrated that the information structure that has more links on the upper levels induced more effective browsing by providing more links. Finally it is recommended that Web designers or Web researchers should consider the information structure in order to analyze the navigation effect of menu design.

Introduction

The popularity and accessibility of the Web have been increasing dramatically and changing the fundamental way to purchase products and services (Yoo & Kim, 2000). As both the amount and availability of products and services on the Web increase, effective navigation is becoming more and more critical to the success of E-commerce. However, navigating a Web site is often not an easy task, especially for novices (Berg, 1997; Dieberger, 1997; King, 1996; Sand, 1996). The potentially complex linking system and information structure awaiting Web customers can cause disorientation, increase cognitive loads (Collis, 1991), and lead to users getting lost in cyberspace (Neilsen, 1990). Hammond and Allinson (1989) contend that users may encounter a number of common problems: "They may have difficulty gaining an overview, finding specific information, or using the interface tools; they may wander without an orienting goal or strategy, or may even get lost"(p. 69).

Web customers navigate through an enormous body of information by following a likely path from one page to another until finding the product they want to buy. As the amount of products and services have been increasing dramatically, the way to organize, present, and access the products has become a crucial issue in order to support customers' effective navigation because the complexity of navigation has increased correspondingly (Berg, 1997, Chen, Mathé, & Wolfe, 1998, Newfield, Sethi, & Ryall, 1998; Pitkow & Recker, 1994). Recent usability tests show similar evidences. Users still get lost very easily on the Web and it is still a dilemma in designing a Web site where users can find information fast and easily (Nielsen, 1997, 1999; Kim, 1995)

Such problems have prompted research on the manner in which users interact with the Web. Many researchers have studied the relationships between the user interface and information structure for effective navigation and information searching. Since the main purpose of the E-commerce Web site is to access products effectively, how the information is structured on the Web site and how the link mechanism is presented on the menu of the Web site can significantly influence the success of navigation effects (Berg, 1997; Br., 1988; Halasz, 1988; Hardman, Bulterman, & Rossum, 1994; Shneiderman, 1998; Shneiderman & Kearsley, 1989).

E-commerce Web sites have been applied many menu designs for better navigation. Numerous Web sites began to employ a pull-down menu since it provides the most versatile path mechanism for fast navigation. The navigation effect of a pull-down menu, however, can be different depending on how information structure is organized. The information structure is invisible to users when they enter the Web site. It is the menu design that provides users with the linking mechanism. They come to understand the structure of the Web site only after interacting with menu. What users perceive from menu design may also differ depending on how information is organized. Therefore, studies investigating the effect of a menu design on the Web should be analyzed with information structure. In other words, the ideal study should be conducted in a situation which employs the menu design and information structure together to allow an analysis of how these two factors have an influence on navigation or information searching performance.

It must be emphasized that the research on navigation or information searching should consider those two factors in the same situation. This study concentrates on a pull-down menu design and information structure in the same line in order to analyze how the pull-down menu design affects information searching performance depending on different information structures.

The Navigational Structure of the Web

Navigation can be defined simply as accessing information on the Web (Gay, 1991). Navigation, however, means more than a process of simply accessing information. Cunliffe, Taylor, and Tudhope (1997) defined navigation as "...high interactivity in a structured environment with the destination seldom pre-determined. Navigation is often a compromise between user and system responsibility; an incremental process with the user making choices from directions and feedback provided by the system..." (p. 99).

A Web site is the networked body of chunks of information with links (Horney, 1993; Jonassen, 1996). The basic technique for navigating a Web site is selecting the paths provided by links (Rosenfeld & Morville, 1998). Navigation in the Web demands users engage in relatively easy activities (typing a URL, using search engines, and moving mouse and clicking links) for navigation. Information structure is how the information is organized on the Web and it provides the primary ways users can navigate through links (Rosenfeld & Morville, 1998). Since users can only create paths based on the links provided, the logical navigation underlying design of those links influences the paths that users can take. Therefore, the structuring of the information plays a fundamental role in navigation (Hardman et al., 1994).

When users enter the Web site, it is not easy to understand the entire information structure of it. Users come to understand its structure as they navigate through the paths provided by the menu design. The fundamental function of the menu is to display links on the screen so that a user can navigate through a Web site (Schwartz & Norman, 1986). A series of interactions among a user, information structure, and menu allow a user to construct a cognitive structure for navigation.

Users exchange the information and control with a given system based on two main components: menu design, which controls the communication with users through linking mechanisms, and the information structure, which relates to how to incorporate the original structure of the content into the structure of a Web site (Chang, 1995; Jul & Furnas, 1997; Marchionini, 1995; Oliveira, Goncalves, & Medeiros, 1999). Although the information structure is invisible to users, they come to understand it when they interact with menus that reflect the information structures. Clearly there are a number of ways menus and information structures vary. For instance, the same information can be structured using a different structure style. There also can be different ways to design the menu to present the same information structure. In that point, it is possible that the information searching performance can be different in situations where users interact with the same menu style that presents a different information structure.

In the research on menu design, a simple and constant information structure has been employed to analyze the effect of menu design. Most studies have investigated only constant, symmetric hierarchies in which the menus at all levels have the same number of items. However, most real-world menus are not constant but vary in the number of alternatives at each level due to the nature of the database (Norman & Chin, 1988). For these reasons, this research employed three information structures in order to examine the navigation effect of a pull-down menu.

Materials and Methods

Pull-down Menu

The pull-down menu design is relatively new on the Web even though it has been used in many other computer applications. Pull-down menus appear over objects in the interface instead of in a static menu area, and they allow users to access directly the Web page they want. The advantage of this menu style is that it provides the most versatile path mechanism for navigation. Users can jump to any page by moving the mouse and clicking without through passing intermediate pages. Many Web sites for E-commerce have been adapting this menu design since users can find information fast.

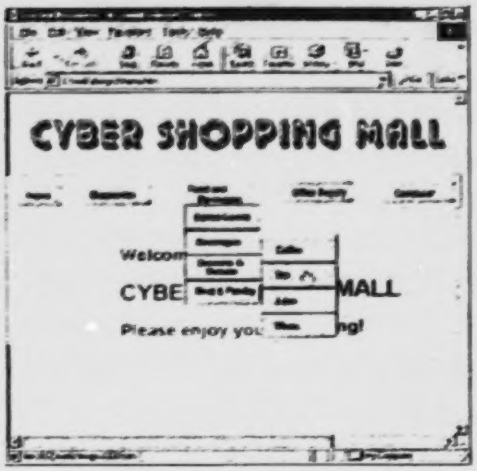
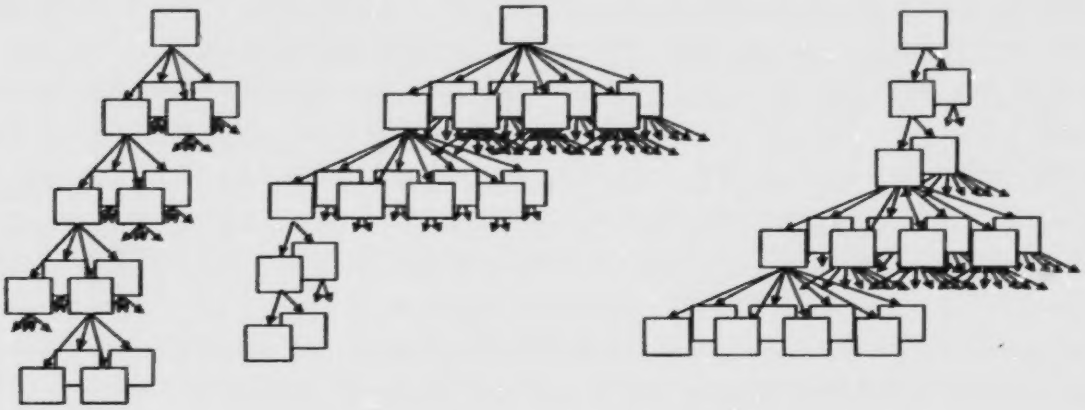


Figure 4. Pull-down Menu

Information Structure

Literature in hypertext and the Web shows that the hierarchical information structure is the most popular and appropriate structure (Morris & Hinrichs; Rosenfeld & Morville, 1998). In this study, the hierarchical information structure on the Web site was organized in three ways: constant, increasing, and decreasing structure. Figure 2 shows three structures for presenting 256 items of cyber-shopping merchandise items with a depth of four levels.



Constant Structure Decreasing Structure Increasing Structure

Figure 5. Three Information Structures

Constant Hierarchical Structure

The constant structure serves as a baseline of comparison since it has been used most frequently in past research. There are four links at each level in constant hierarchical structure (4 x 4 x 4 x 4).

Decreasing Hierarchical Structure

The decreasing hierarchical structure gives a large number of choices at the top of the menu and narrows the range of choice at the bottom. In this structure, there are eight links at first and second level and two links at third and forth level (8 x 8 x 2 x 2).

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Increasing Hierarchical Structure

The increasing structure gives a small number of links to the user at the top level of pages and increases the number of links at the bottom. There are two links at first and second levels and eight links at third and fourth levels (2 x 2 x 8 x 8).

Table 1 shows a summary of three Web site variants comparing the number of pages and links for each experiment. Each information structure was organized with a total of 256 pieces of information in a depth of four levels. However, the number of Web pages at each level in each information structure is different. For example, the experimental Web sites where constant information structure (4 x 4 x 4 x4) was organized with a pull-down menu designs have a total 85 numbers of Web pages. In the experimental Web sites 2, each Web site was consisted with a total number of 201 pages while experimental Web site 3 has only 39 pages in total.

Table 1. Comparison of Number of Pages and Links in Experimental Web sites

Websites	Information Structure	Number of Pages					Number of Links			
		Level					Level			
		1	2	3	4	Total	1	2	3	4
1	4x4x4x4=256	1	4	16	64	85	84	84	84	84
2	8x8x2x2=256	1	8	64	128	201	290	290	290	290
3	2x2x8x8=256	1	2	4	32	39	38	38	38	38

The most important fact in experimental systems is that the number of links is different from each other since it is determined by the shapes of information structure. For instance, the number of links at each page is 84 with constant structure, 290 with decreasing one, and 38 with increasing one when users open the all pull-down menus. The main focus of this study is how these differences caused by combination of different information structures and a pull-down menu affect users' information searching and other perception on appeal, usability, and disorientation.

Selection of Searching Task

In order to measure the influence of three different information structures on the Web site, this study included two types of tasks: searching and browsing (Canter, Rivers, & Storrs, 1985). Each five searching and browsing tasks were included in this study. The examples of each task were as follows:

- Searching task: You want to buy Epson Color 200 printer in this Web shopping mall. Please find the price of this printer in this site.

- Browsing task: Your father likes music very much and you want to buy a birthday gift for your father. Please select the music item that will make your father happy.

Participants

Total 60 undergraduate and graduate students participated at mid-western university in this study voluntarily. We excluded two subjects from final analysis because one subject had a serious sight problem due to her age and another subject missed or misunderstood several tasks due to language problem. The age of the former subject was 54years old, and the latter subject was an international student who was taking an intensive English program first level. Therefore, the actual number of subjects for the final analysis was 58. Subjects ranged in age from 20 to 49 years. They were diverse in terms of their computer and Internet related abilities.

Procedures

This experiment consisted of three sessions. During the first session, a participant was asked to fill out the background information form. It took approximately five minutes to fill out this form. After completing the questionnaire, a participant was assigned to one of three treatments randomly and was asked to find the answers of 10 tasks. Each task was given to the subject one at a time.

The subject was told to tell the researcher "start" before he/she started each searching task and to tell the researcher "the price of the item" after he/she found the answer. During information seeking tasks, the researcher measured the time for each task. This procedure continued until the subject finished all 10 tasks. It took approximately 10 to 15 minutes for a subject to finish all tasks. After completing the test session, the participant was asked to complete an attitude questionnaire. This took about 5 minutes.

Results

Information seeking performance, as mentioned earlier, was divided into two task types: searching task and browsing. ANOVA statistics showed the result of effect of searching task on time to spend finding answers among three structure designs (see Table 2). There was no significant difference among three structure designs, $F(2, 55) = .35, p > .05$.

Table 2. An ANOVA Summary Table With Group Means and Standard Deviations for Searching Task by Structure Design

Structure	N	M	SD
4 × 4 × 4 × 4	19	47.22	20.08
8 × 8 × 2 × 2	20	43.75	22.85
2 × 2 × 8 × 8	19	50.74	32.86

Source	df	SS	MS	F
Structure	2	476.93	238.47	.35
Error	55	37171.69	675.85	
Total	57	37648.62		

Tables 3 showed that there was significant difference among three structure designs in terms of browsing task, F (2, 55) = 3.86, p < .05. Tukey's HSD post-hoc comparisons were used to determine significant differences between means at p < .05. Post hoc comparisons results revealed that there was a significant difference between increasing information structure (2 × 2 × 8 × 8) and decreasing information structure (8 × 8 × 2 × 2). The amount of browsing time of increasing information structure (M = 56.55, SD = 15.49) was longer than that of decreasing structure (M = 42.05, SD = 8.95), p < .05.

Table 3. An ANOVA Summary Table With Group Means and Standard Deviations for Browsing Task by Structure Design

Structure	N	M	SD
4 × 4 × 4 × 4	19	47.32	22.04
8 × 8 × 2 × 2	20	42.05	8.95
2 × 2 × 8 × 8	19	56.55	15.49

Source	df	SS	MS	F
Structure	2	2087.76	1043.88	3.86*
Error	55	14878.72	270.52	
Total	57	16966.47		

* p < .05.

The following results, on the other hand, showed that there was significant difference among three structure designs with respect to three participants' perceptions: the degree of perceived appeal, usability, and disorientation.

As shown in Table 4, there was statistically significant difference in the degree of users' perceived appeal in terms of three structure designs, F (2, 55) = 4.60, p < .05.

Table 4. An ANOVA Summary Table With Group Means and Standard Deviations for Users' Perceived Appeal by Structure Design

Structure	N	M	SD
4 × 4 × 4 × 4	19	17.21	4.66
8 × 8 × 2 × 2	20	20.65	4.09
2 × 2 × 8 × 8	19	15.63	6.80

Source	df	SS	MS	F
Structure	2	258.03	129.01	4.60*
Error	55	1544.13	28.08	
Total	57	1802.16		

* p < .05.

Tukey's HSD post-hoc analyses also were conducted to examine differences in users' perceived appeal among three structure designs. There was significant differences between decreasing information structure (8 × 8 × 2 × 2) and increasing information structure (2 × 2 × 8 × 8). That is, the degree of users' perceived appeal for decreasing information structure (M = 20.65, SD = 4.09) was higher than that of increasing information structure (M = 15.63, SD = 6.80), p < .05.

Table 5 showed that there was statistically significant difference in the degree of usability in terms of three structure designs, F (2, 55) = 5.61, p < .05.

Table 5. An ANOVA Summary Table With Group Means and Standard Deviations for Usability by Structure Design

Structure	N	M	SD
4 × 4 × 4 × 4	19	15.68	1.92
8 × 8 × 2 × 2	20	17.30	2.56
2 × 2 × 8 × 8	19	14.00	4.28

Source	df	SS	MS	F
Structure	2	106.11	53.05	5.61*
Error	55	520.31	9.46	
Total	57	626.42		

* $p < .05$.

Post-hoc analyses showed that there was significant differences between decreasing information structure (8 × 8 × 2 × 2) and increasing information structure (2 × 2 × 8 × 8). The degree of usability for decreasing information structure (M = 17.30, SD = 2.56) was higher than that of increasing information structure (M = 14.00, SD = 4.28), $p < .01$.

Finally, as shown in Table 6, there was also statistically significant difference in the degree of disorientation in terms of three structure designs, F (2, 55) = 4.35, $p < .05$.

Table 6. An ANOVA Summary Table With Group Means and Standard Deviations for Disorientation by Structure Design

Structure	N	M	SD
4 × 4 × 4 × 4	19	10.68	3.75
8 × 8 × 2 × 2	20	8.40	3.47
2 × 2 × 8 × 8	19	12.47	5.51

Source	df	SS	MS	F
Structure	2	162.84	81.42	4.35*
Error	55	1029.64	18.72	
Total	57	1192.48		

* $p < .05$.

Tukey's HSD post-hoc comparisons results revealed that there were significant differences between decreasing information structure (8 × 8 × 2 × 2) and increasing information structure (2 × 2 × 8 × 8). The degree of disorientation for decreasing information structure (M = 8.40, SD = 3.47) was lower than that of increasing information structure (M = 12.47, SD = 5.51), $p < .05$.

Discussions and Conclusions

The important outcome of the study was that the information structure had an influence on the navigation performance of the pull-down menu on the World Wide Web. Results showed that the combination of decreasing information structure and a pull-down menu resulted in faster browsing performance, higher appeal, higher usability, and lower disorientation, while performance and attitudinal assessments were worse when a pull-down menu was combined with increasing information structure.

As reviewed in the previous section, each information structure was organized with a total of 256 pieces of information in a depth of four levels. However, the number of Web pages and links at each level varies in each case. The decreasing information structure has more links than the increasing information because a decreasing information structure consists of more information on the upper level and less information on the lower level, while an increasing information structure is the reverse.

Customers who employ a browsing strategy to purchase a product or service need more information not only for narrowing down their purchasing ideas but also for navigating the E-commerce system. It is important for customers who browsing products to provide more links or selections because they can see more products without additional navigation activities. This may help customers decide the product to buy. The result of users' attitudes supports this explanation. Users perceived a Web site more appealing, more usable, and less disorientating under a decreasing information structure than an increasing information structure. Therefore, the differences in the number of links provided by information structure may have influenced the navigation effect of a pull-down menu.

This study failed to show significant differences on searching performance. There are three possible explanations for no significant differences on searching speed being found. First, the information structures may be not complex enough to detect the differences of the speed on searching performance. All three information structures were organized with 256 information in four level depths with different shapes. Even though each structure has a different number of links and of possibility of error selecting the right path, the differences among the three structures may not be complex enough to reveal the interaction with different menu designs on searching performance. Second, the level of task difficulty of directed browsing may have been too low to reveal differences among three information structures. The tasks for directed browsing were to find simple information in this study. Lai's (1994) study showed that there was no difference on the participants' searchingperformance when the tasks were at a low level of difficulty, regardless of the experimental treatments. This study's results are consistent with her findings.

There are several limitations to the current study. First, this study employed only three information structures for the experiment. However, there are more diverse information structures in the real Web sites. Therefore, further studies should be conducted with more diverse information structures in order to investigate the information searching performance. Second, the information structure used in this study was the hierarchical structure with four pages at each four levels. The information structures in the real Web sites are not constant but varied. The research should expand to more different types of information structure (e.g. linear, matrix, network) and different shapes of hierarchical structures with different level of depths. These differences in information structure may result different in effects of menu design. Third, the population of participants was limited to undergraduate and graduate students in a mid-western university. Most of them had the basic skills in computer and Web. Further research should expand the population of participants.

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Preface

For the twenty-fourth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. This is *Volume #2 of the 24th Annual Proceedings of Selected Papers On the Practice of Educational Communications and Technology* Presented at The National Convention of the Association for Educational Communications and Technology held in Atlanta, GA. A limited quantity of these Proceedings were printed and sold. It is also available on microfiche through the Educational Resources Clearinghouse (ERIC) system.

This volume contains papers primarily dealing with instruction and training issues. Papers dealing with research and development are contained in the companion volume (24th Annual, Volume #1), which also contains over 60 papers.

REFEREEING PROCESS: Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately fifty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

M. R. Simonson
Editor

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Relate@IU >>> Share@IU: A New and Different Computer-Based Communications Paradigm

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Roberto Joseph
Ali Korkmaz
Jeong-En Oh
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Abstract

The purpose of this study was to examine problems with the current computer-based electronic communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU. Understanding the concept of sending links to resources, rather than sending the resource itself, is at the core of how Relate@IU differs from the traditional communications models. Instructional Systems Technology faculty and students were invited to participate in focus group sessions, where they were presented with an initial prototype of Relate@IU.

Our findings from the focus group sessions indicated that the current electronic communication systems are meeting user needs, while generating new needs that currently are not being met. This report reveals these newly generated needs stemming from the problems with current electronic communication systems. Relate@IU is intended to solve many of these emerging problems.

Following the initial testing of the Relate@IU prototype, we developed an updated computerized version of Relate@IU, named Share@IU. We are currently developing PHP scripts which will be tested on a small scale.

Introduction

Technology utilization in higher education has been witness to a dramatic increase in recent years. Two main areas of increase have been in electronic mail (Email), and Web technologies. "Three-fifths (59.3 percent) of all college courses now utilize electronic mail, up from 54.0 percent in 1999, 44.0 percent in 1998 and 20.1 percent in 1995. Similarly, two-fifths (42.7 percent) of college courses now use Web resources as a component of the syllabus, up from 10.9 in 1995, 33.1 percent in 1998 and 38.9 percent in 1999. Almost a third (30.7 percent) of all college courses have a Web page, compared to 28.1 percent in 1999, 22.5 percent in 1998 and 9.2 percent in 1999" (The Campus Computing Project).

Well-known problems exist with e-mail and asynchronous conferencing systems. Many people get flooded with e-mail messages they do not want in their inboxes ("e-mail assault" or "Spam"). Negotiation in advance between a sender and a recipient to agree to communicate is not allowed under the current e-mail paradigm; e-mail filters are often marginally effective. Furthermore, if one sends a large attachment to a group, then a copy of the attachment is delivered to each recipient's inbox and may cause inbox quota overflows as well as network congestion.

While we have seen a dramatic increase in the utilization of communication technologies, there has been a distinct absence of new communication paradigms to match the current needs of users. Current literature suggests that "…communication may be a more important use and determinant of participants' commitment to the Internet than is information acquisition and entertainment" (Kraut, Mukhopadhyay, Szczpula, Kiesler, and Scherlis, 1998). Problems still reside with the current electronic communication systems and a better paradigm needs to be considered.

Literature Review

Computer-Based Communication Systems

Computer-based communication systems require three basic components: hardware, software, and telecommunication lines (Harasim, Hiltz, Teles, & Turoff, 1995). Hardware components include a personal computer or workstation and an Internet connection. A Second component is the software used for group interaction (e.g., bulletin boards, electronic mail, and computer conferencing system). Lastly, telecommunication lines are needed to link the computers to groups of people to communicate and learn together.

Problems with the Current Computer-Based Communication Systems

E-mail. An E-mail system is an electronic data transfer tool to exchange messages over networks. Most E-mail systems have capabilities for attaching files to messages to facilitate the exchange of large amounts of information (Harasim et al., 1995). The distributive nature of E-mail has lead to some of the current problems being experienced by users. One such example of this is the phenomenon of attachments. Graphical E-mail applications such as Microsoft Outlook and Eudora allow for documents to be attached to an E-mail message with ease. This attached document, however, has the potential to spread information, or a virus, with extreme speed. Also, the file size of attached documents is large relative to a normal E-mail message. This large size can lead to an over-quota status of the recipients E-mail account. When such accounts are over-quota, other electronic messages cannot be delivered. There are numerous other examples of the problems users face every day with E-mail which will not be discussed here.

Computer collaboration systems. According to Harasim et al (1995), computer collaboration systems allow joint collaboration in a method other than exchanging isolated pieces of information (i.e. Email attachments). It provides groups with specific spaces inside the software that can be tailored to their needs. Each group communication space has access privileges set by the person who creates the space. Each collaboration space provides lists that allow participants to tell who has accessed what material. Changes on earlier contributions and notifications of changes are also possible. Contrary to such strengths, however, computer collaboration systems have some weaknesses. The most common difficulty is technical problems: people do not know how to use collaboration systems. They are lost in a system, fail to edit online, and have difficulties uploading and downloading documents (Harasim et al., 1995). These problems relate to the specifics of the collaboration system or the interface between the hardware and software – there are various types and versions of collaboration systems. Another problem is communication anxiety, which comes from lack of immediate or appropriate responses within a reasonable time. This is especially true for asynchronous environments where immediate interactions are not possible. People also have difficulties managing increased information flows. With networking and increased access to education and information, the key challenge becomes learning how to manage the information overflows.

Transformation to Peer-to-Peer Computing

Peer-to-Peer computing provides individual users with direct connections to desktop computers for communicating. This is in contrast to the more familiar centralized model of computing used for broadcasting information and electronic commerce. In the following passage, Lewis (2000) describes the transformation from a centralized model of computing to a peer-to-peer model.

"The Internet transformed the world by linking computer networks. The World Wide Web transformed the Internet by making it easy to link files on those computers. Now another major transformation is occurring. By enabling millions of computer users to search for files and transfer them from one desktop computer to another, instead of the current model in which files are typically stored on and retrieved from a central Internet computer called a server, the balance of power shifts from the commercial interests that now dominate the Internet to the individual." (Lewis, 2000)

Since the spring of 2000, peer-to-peer computing has been gaining momentum in the business community. This spur in momentum is largely to due the growing popularity of Napster, the music exchange service. One company who has been leading the way with peer computing innovations is Groove Networks. They have developed an Internet communications software program called Groove, which allows people with shared interests to make direct connections for real-time interaction. According to the company, "Groove moves beyond the World Wide Web paradigm, leveraging the two-way capabilities of the Internet to provide a peer computing platform for use by individuals and small groups, in both a business and personal context."

According to Groove Networks, peer computing innovations have come in three different flavors: Direct access to information, Direct access to computing power and Direct access to people. At the core of these three peer-to-peer innovations is the type of ACCESS we as individuals require/enjoy. Peer-to-Peer computing places the user in control. It is clearly a user-centered approach to computing. People are attracted to peer computing for (a) creating a shared context among a group, (b) having the flexibility to add functions on an as needed basis, and (c) making connections without having to go through a centralized resource. These reasons naturally combine to allow people to gather together to make informed decisions quickly.

Purpose of the Study

The purpose of this study is to examine major problems and needs with the current computer-based communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU.

Research Questions

This research focused on two sets of questions. The first set focused on the general use of the current electronic communication systems. The second set focused on the capabilities of Relate@IU. The general questions were: (a) How are you using electronic communications technologies? (b) What major problems have you encountered with electronic communications technologies? (c) What types of improvements would you like to see in the future? (d) If you could dream of a system, any system, that could make your communication life simpler, what would it look like? and (e) Do you feel that current online collaboration tools are meeting your needs? The specific questions related to Relate@IU were: (a) Are there any aspects of the prototype that still need clarification? (b) What problems do you see with the current state of the prototype? (c) What critical characteristics of online collaboration are missing from the prototype that you would like to see included? and (d) How would you improve the interface?

Methodology

Relate@IU

Relate@IU is not the same as e-mail, the Web, or asynchronous conferencing as typically implemented. It is a new e-collaboration tool that is distinguished from the current computer-based electronic communication system.

Table 1. Current Computer-Based Communication Systems vs. Relate@IU

	Current Systems		Relate@IU
	E-mail	Collaboration Tool	
Relationship	Not negotiated	Negotiated	Negotiated
Location of Files	Multiple E-mail Servers	Shared Server	My Web Space
Ownership	Creator & Recipients	Creator & Recipients	Creator
Item Exchanged	Message, File & Link	Message, File, & Link	Subject Line & Link
Number of Copies	Number of recipients	One	One

Negotiation of relationships. With the current computer-based electronic communication systems, relationships are not negotiated. With e-mail addresses, anyone can send another person as much information or as many files as they like. Regarding unwanted e-mails, people spend several hours a week just deleting them. No control exists between a sender and a recipient, and it makes people suffer from such problems as "e-mail assault", over-quota in the recipients' e-mail inboxes, etc. In order to increase effective and efficient use of electronic communication systems, selective information needs to be exchanged with selective people. With the new system, it is envisioned that negotiation must occur among people who agree to collaborate.

File linking system. With our current electronic communication systems, we send out messages, files, or links. Besides unwanted e-mails, what slows down swift communication is the exchange of large files. Under the current e-mail systems, files are sent out as attachments. If modification is needed after a file is sent out, a different version of file is sent out. If modifications are made frequently, outdated files pile up in the recipient's mailbox until the recipient deletes them; this can cause the mailbox to reach its quota and in worst case, new e-mail messages are rejected by the system. Under the new system, people never send out files; what is sent to others in the collaborating group is a link to the owner's file. The new system is a file linking system, and the access to the file is restricted exclusively to the collaborating group.

One file in one place – control on ownership. With the current electronic communication system, exchanged files reside in e-mail servers or, in the shared server of an electronic collaboration system. In order to distribute a file to multiple individuals, essentially the initiator is making multiple copies of that file. Under Relate@IU, every person saves his own files on his Web space and can exercise controls on the relationships with people in terms of accesses to the files: read-only or modification-enabled. Files are never sent out and remain property in possession of the owner, and people are given permission to view and/or modify the files. However, once another person is viewing a file, he or she normally cannot be prevented from saving it on his/her own storage device (i.e., cannot be prevented from making a duplicate copy).

Design Prototype

The researchers held a brainstorming session to begin to conceptualize the fundamental principles of the new electronic communications system, Relate@IU. One of the important products of our brainstorming session was a comparison table highlighting the key conceptual differences between the current electronic communications systems and the Relate@IU system (see Table 1). Also, sketches of the initial prototype and development notes were developed during the brainstorming session. From these sketches, we were able to design an initial prototype to present during our focus group sessions.

Fortunately, our focus group audience understood the nature of rapid prototyping, and that this initial prototype, although presented in an electronic form (Microsoft PowerPoint), was just the first of many iterations.

Configurations of current electronic mail (e-mail) systems drove the development of the Relate@IU prototype. Current e-mail systems can organize messages in ascending or descending order by when the message was received, who sent the message, if the message was red flagged (used to note high importance), or if the message contains an attachment. Beyond this, users also have the ability to sort their messages into sub-folders. This organizational structure was also incorporated into the Relate@IU prototype. Our prototype presents users with sub-folders that represent each relationship they belong to. From this point, requests are presented in the order that they were received; however, they could be re-organized in ascending or descending order by action requested (read or review), subject, file location, or date received.

At this point, a functional overview of the current prototype may be beneficial. To start, a user would open their Relate@IU web page, and then be prompted to log into the system. The next screen to be displayed would have a list of current relationships on the left, a toolbar to create relationships and send requests at the top, and the main information display window located to the right of the relationships list. The main information display area contains two types of information, requests that individuals or groups have made to you, and your requests to individuals or groups. The content that is displayed in this area is controlled by your selection of an existing relationship from the relationships list on the left of the screen. The tool menu at the top of the screen also affects the relationship that has been selected from the relationships list on the left side of the screen.

Forming relationships can be done at any time by selecting the "Create / Modify Relationship" tool. A pop-up window appears and allows the user to enter a title of the relationship, who is involved in the relationship, and what privileges they have at the folder level (read only or modify).

The Relate@IU system differs from the traditional e-mail system in the fact that it does not send an actual message. This new system sends a subject line and a link to a file. This file could be anything from a word processing document, to a digital image, to an audio file.

Understanding the concept of sending links to resources, in place of sending the resource is at the core of how Relate@IU differs from the traditional communications models. In order to facilitate our focus group participants understanding of this concept, we first asked them a series of questions designed to have them think about their experiences with current electronic communications systems.

Next, we presented a comparison table highlighting the key conceptual differences between the current communications systems and the Relate@IU system. At this point, we showed the focus group participants our prototype, and talked through a scenario of how the tool would be used.

The Focus Group Interview

We used focus groups as a primary method of data collection in order to stimulate new ideas, creative concepts, diagnose potential problems and to generate impressions of our new electronic communications system, Relate@IU. We conducted three separate focus group interviews. Two of these sessions were student focus groups, and the third session was a faculty focus group. We collected the data during the focus groups by video taping the sessions. Stewart and Shamdasani (1990) recommend ordering the guiding questions from general to more specific. An agenda containing guiding questions for the focus group sessions was designed by the researchers to guide the flow of the discussion. Each participant was provided with a copy of the agenda. The researchers decided to conduct the focus group sessions prior to the one on one interviews in order to solve initial conceptual problems with the prototype. In addition, the researchers wanted to gather data that would aid in improving the interface of the prototype, prior to presenting it in a one on one interview situation. According to Morgan (1997) "...follow-up interviews can help provide depth and detail on topics that were only broadly discussed in group interviews." Focus groups are a somewhat informal technique that can help assess user needs and feelings both before interface design and long after implementation (Nielson, 1997).

Research Site

Participants for this study were drawn from the Indiana University Bloomington (IUB) campus, and more specifically the Instructional Systems Technology Department (IST). The IST Department is located within the School of Education. We conducted our focus group sessions in the main IST classroom.

Research Participants

A purposeful sampling approach was used in this study in order to maximize variation among the research participants. Purposeful sampling is used as a strategy when one wants to learn something and come to understand something about certain select cases without needing to generalize to all such cases (Patton, 1980). Each participant was contacted via e-mail, informed of the purpose of the study, and was asked to participate. In particular, we were interested in selecting a variety of IST masters and doctoral students, early or late in their program, spoke English as a first or second language and were male or female. In addition, we were also interested in selecting IST faculty.

Study participants include three masters, four doctoral, and three faculty. Among the students, three were male and four were female, and among the faculty, one was a female and two were male. All except for two participants spoke English as a first language.

Results

General Questions

Below are the general questions from the focus group interview, followed by key points that were raised.

1. How are you using electronic communication technologies?

All participants indicated that they utilized SiteScape Forum (SSF) for document sharing with classes. E-mail was also used by all participants for academic and personal communications. One participant stated that File Transfer Protocol (FTP) was still utilized for posting documents to a server space. Most participants stated that they utilized online search engines to locate information and updates on the World Wide Web (WWW).

2. What major problems have you encountered with electronic communications technologies?

A majority of participants reported problems with a lack of system interoperability (e.g. MS Word and WordPerfect, Macintosh and PC platforms). This was mirrored by a large number of participants reporting difficulties in moving a document from one system to another.

Electronic mail was another source of difficulties for our participants. Few reported problems with junk mail (Spam), about half reported difficulty with reading attachments (associated with the PINE e-mail system). Quickly reaching the maximum quota (file storage allotment) was also of concern to about half of our participants. A few participants commented about the difficulty in replying to challenging e-mails, stating that they don't know how to answer or what to do with the message.

When dealing with multiple communications systems, a majority of participants had commented on the tedium of logging in to multiple forums, specifically with SSF, and then having to remember not only multiple passwords, but also which forum to access. A few participants had difficulty with the unintuitive interface with SSF. Our faculty focus group noted that there is no integration between the various commonly used communications systems such as SSF and e-mail. SSF server downtime was noted by a just under half of our participants as a major source of difficulty.

3/4. What would your dream system look like?

Although we did receive a range of responses to this question, there was no one feature that was repeated with a high frequency. Almost half of the participants had indicated that they wished to have greater control of how, and with whom, they collaborate. One third of the participants would like to see human-like intelligence with advanced filtering, prioritizing, and automatic archiving of electronic mail and data. The ability to customize the system, and visual communications were both mentioned by one fifth of our participants. There were a number of responses that were unique. These suggestions ranged from a seamless integration of the most commonly utilized systems, to having a system be able to recognize what type of file is being used, to a tracking and check-in / check-out system for working with documents in an online collaborative file sharing environment. One common dream was that of unlimited storage space

5. Do you feel the current system is meeting your needs?

Half of all participants responded that yes, the current communications systems are meeting their needs. However, there were a number of conditions that were placed on this response. One condition was that collaboration at a distance works with a relatively small number of people. Another condition is that the current technology is forcing users to follow specific rules, in other words users are submissive to the technology. One participant stated that due to limited experience with electronic collaboration, that they were uncertain as to what there needs were, and therefore was uncertain if the current systems were meeting those needs. Another participant was not satisfied with the inadequacies in the discussion type tools, particularly for students and classes. A few participants made the comment that current online collaboration tools are meeting many of my needs and generating new needs that are not being met.

Responses to the Prototype

Below are the focus group responses to the current Relate@IU prototype.

Comment 1: If you send a link to 10 people, how do you know who read it if when one person reads it and it changes to non-bold?

At the present time there is no understanding on our part as to how this tool could display which members of a group have opened the document, and who has not.

Comment 2: Would it send you some sort of notification (if someone sends you a request to collaborate)?

The current system was designed with the idea that it would be its own system, not tied into other IU systems. People would agree to work together via current methods, and then go to the Relate@IU tool to assist them in their collaboration. Relate@IU was not viewed as an initial step; however there is room for redesign.

Comment 3: I'm thinking four people in a group, 3 classes, that's 12 individuals – do I want to set up 12 relationships?

For three different groups you would have to form three different relationships. It is possible to have multiple individuals involved in one relationship. SiteScape Forum (SSF) might be a more appropriate tool for collaboration in cases similar to this.

Comment 4: So this wouldn't be for sharing documents with a group, I would share my stuff, but it's not a place where the group has...

A group of individuals may have access to read or modify documents that currently exist in your web space; however, the current design of the system does not allow users to place a file in another user's space. One member of a group can send a link to the file, and other members of the group can access the file, but there is no central repository for the group to store documents.

Comment 5: (A) Problem would be that there is no identification of who is sending a request when multiple people belong to a group (i.e. project team)

Currently, the system recognizes users as either an individual user, or as one user accessing an account that has multiple users. The system can be redesigned to utilize usernames to identify the individual who sent the request, as well as to identify which users have accessed documents.

Comment 6: All most everyone I know I have multiple types of relationships with, how would I manage that?

Comment 7: What I'm seeing is that the relationships are all about document sharing.

Relate Becomes Share@IU

A paper prototype was built to simulate the functions that were determined in the Relate@IU research study. Usability tests were conducted with this paper prototype. Some problems were found with the paper prototype and users suggested some changes to this prototype. Due to the nature of this study, we were open to ideas and suggestions of the users. Furthermore with the considerations of these problems and suggestions, two more computer prototypes were developed and further usability tests were done. During this development stage, we were determined to develop a user-friendly system. If this new system is seen as a new tool to learn or require training, people might resist using it. We wanted to make sure that it was usable by various types of computer users and we tested this with a wide variety of users.

When we started to mock up Share@IU, we identified the critical functions required for the system. We recognized that there were fundamentally three different categories of functions: File management, communication and group functions. We identified the sub functions under these categories. The File Management system is similar to Windows Explorer or generic FTP programs. We developed a similar interface for the File Management System part of Share@IU. Communication and group level functions were added to this interface.

In the File Management Functions, the user (owner of Share@IU space) can create a folder, upload files, determine where s/he is working, navigate between folders (up a level or down to subfolders), and determine the files in the folder with their size and modification date. In the Group Functions, the user can determine who can have access to that specific folder. In the Communication Functions, the user can send a message to the group about the uploaded files (see Figure 1).

In the following figures, some shots of the electronic prototype of Share@IU are shown. This is the view of a Share@IU owner. If the user sends a message to his/her group, they don't see the files in this way they just follow the link, and can see what is allowed for him/her.

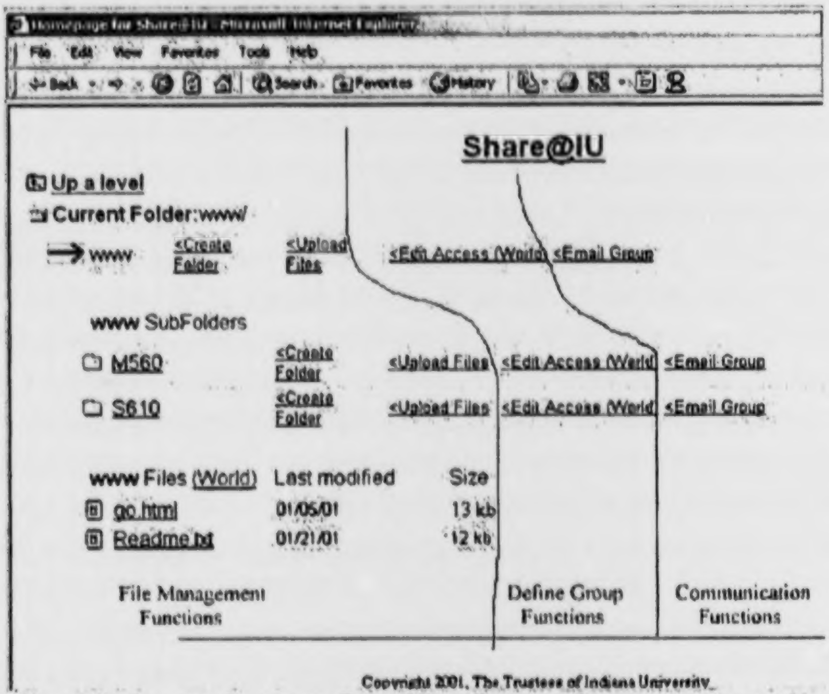
Homepage for Share@IU - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Share@IU
Up a level
Current Folder:www/
www
<Create Folder
<Upload Files
<Edit Access (World)
<Email Group
www SubFolders
M560
S610
<Create Folder
<Upload Files
<Edit Access (World)
<Email Group
www Files (World)
Last modified
Size
go.html
01/05/01
13 kb
Readme.txt
01/21/01
12 kb
File Management Functions
Define Group Functions
Communication Functions
Copyright 2001, The Trustees of Indiana University

Figure 1: Share@IU Computer Prototype: General View (Separator lines are superimposed here, but not seen by user)

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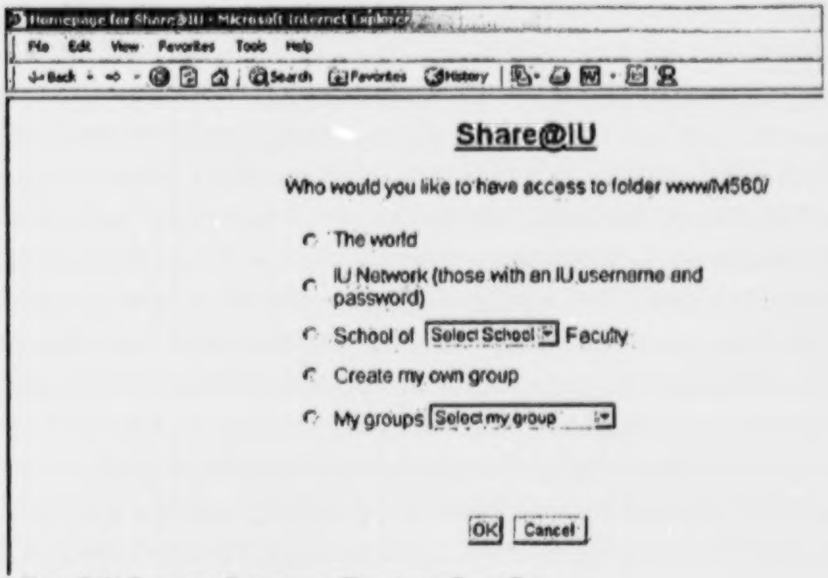

Homepage for Share@IU - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History

Share@IU

Who would you like to have access to folder www/M560/

○ The world

○ IU Network (those with an IU username and password)

○ School of Select School Faculty

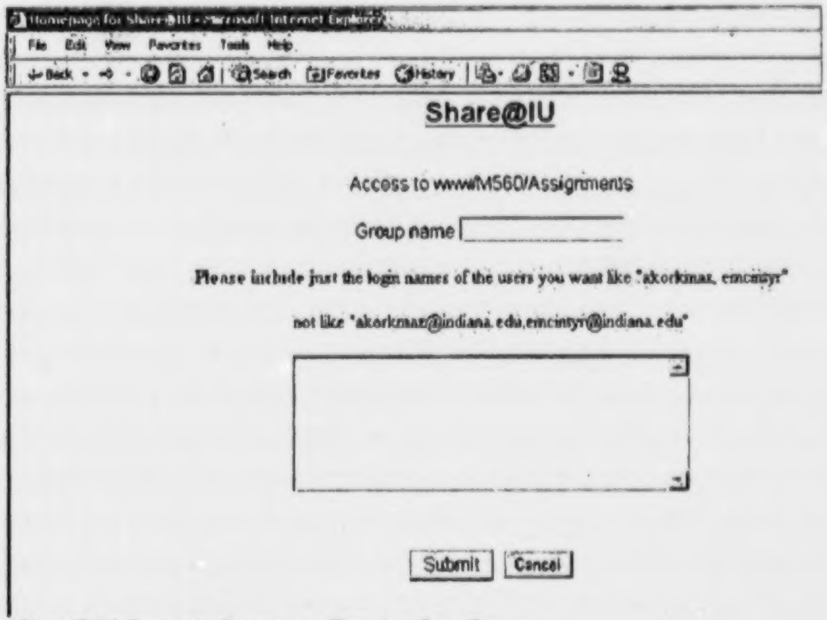
○ Create my own group

○ My groups Select my group

OK Cancel

Figure 2: Share@IU Computer Prototype: Choosing a GroupType

The user determines his/her folder access level. S/he can choose either of these options and accordingly sets the folder accessibility to the defined group (see Figure 2).


Homepage for Share@IU - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History

Share@IU

Access to www/M560/Assignments

Group name

Please include just the login names of the users you want like "akorkmaz, emcintyr"

not like "akorkmaz@indiana.edu,emcintyr@indiana.edu"

Submit Cancel

Figure3: Share@IU Computer Prototype: Creating Own Group

If the user wants to determine specific users, s/he can choose "create my own group" option (see Figure 2) and determine the user ids and add them to the list (see Figure 3).

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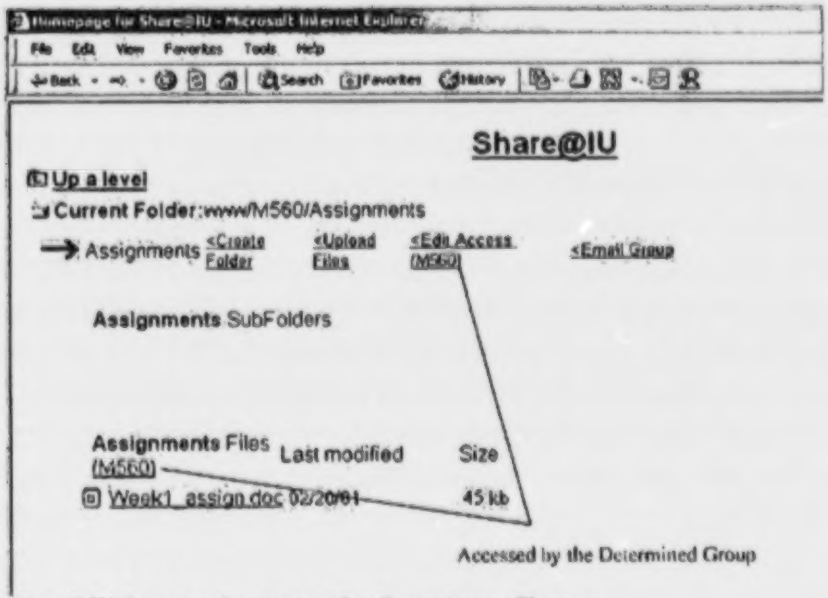

Homepage for Share@IU - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
<Create Folder
<Upload Files
<Edit Access (M560)
<Email Group

Share@IU

Up a level

Current Folder:www/M560/Assignments

Assignments

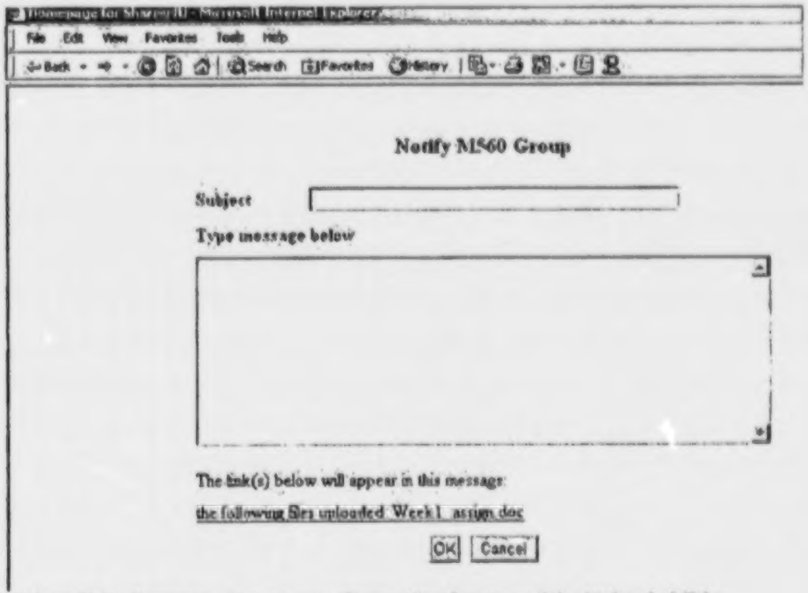
Assignments SubFolders

Assignments Files (M560)	Last modified	Size
Week1_assign.doc	02/20/01	45 kb

Accessed by the Determined Group

Figure4: Share@IU Computer Prototype: After Group Access Changes

After user determines the accessibility of the folder, the folder's accessibility level changes and files and folders in that folder change automatically (see Figure 4).


Homepage for Share@IU - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
OK
Cancel

Notify M560 Group

Subject

Type message below

The link(s) below will appear in this message:

the following files uploaded: Week1_assign.doc

Figure 5: Share@IU Computer Prototype: Group Notification of the Uploaded Files

If the user wants to inform the group about the uploaded files, s/he can send a message by clicking on "E-mail group" option (see Figure 4). They can add a message and subject for their e-mail (see Figure 5)

Limitations and Future Plans

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Due to purposive sampling in the initial qualitative study, generalizability of findings beyond the specific group investigated is not warranted. The results were nonetheless useful in shaping the direction of subsequent prototypes, and further usability testing of those prototypes helped to improve their design.

Share@IU is still a prototype (simulation) that has not yet been implemented as a working product. As we develop a functioning product, additional usability tests will be conducted to refine the design. It is our hope that Share@IU can be implemented on a variety of operating systems (e.g., Unix, Linux, MS Windows, Macintosh) running standard Web servers (e.g., Apache, IIS). Scripts will be written in PHP, which will run as CGI applications on the server side. Users will be able to access Share@IU through standard Web browsers (e.g., Netscape, Explorer, AOL, Opera) with normal Internet connections (PPP), and read messages generated by Share@IU with any standard e-mail system (e.g., Eudora, Outlook, Messenger).

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Collaborative Cultural Studies over the Internet; Learning cultures with virtual partners. A Project between Baylor University and Tokyo Institute of Polytechnics

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Introduction

> "Culture is a complex, abstract, and pervasive matrix of social elements that functions as an all-encompassing form of pattern for living by laying out a predictable world in which an individual is firmly oriented."
>
> Richard Porter & Larry Samover

Offering a predictable world and orienting students in that controlled environment offer the faculty a new level of challenge. Technology makes this task possible. The ultimate goal of this project challenges us to create and provide a communicative environment in which is most natural to L2 and C2[1]. We seek to teach in the world where the instructors and students coexist in non-artificial simulation.

The computer-assisted classroom is no longer a simulation, but a real life. The idea of "Learning can be undertaken in state-of-the-art classrooms, but can also be integrated into the living arrangements" (Gilman) is obsolete. In 21st century life, our lives globally connect to each other with technological network. The networked life is the living life. In that environment, one of the most important issues is the understanding of L2 and C2 to make successful communications.

Since the fall semester of 1995, students at Baylor University taking Japanese and students at Tokyo Institute of Polytechnics have had opportunities to communicate each other and learn together at in a real-world situation. Until the fall 2000, the format limited them to e-mail communication. Today, we have begun a new adventure in learning culture and communicating appropriately with the colleagues from the other side of this planet using other Internet tools.

Software and Hardware Used

Communication software, iVisit, utilizing web-based camera provides an instant visual, oral, and aural transoceanic communication along with text chat. This method brings a classroom halfway across the globe next door. We use this web-based free-of-charge software in the introductory and concluding discussions. Due to our hardware limitation, each school used one web-based camera.

FirstClass offers students to communicate in the manner of a bulletin board service. It allows students to leave messages, possibly enhanced with graphical and audio files, anytime of the day from anywhere in the world. It allows students to read the postings and share ideas. Contrary to iVisit, FirstClass gives time to students to think and examine what to post. The client software is free-of-charge and supports many different platforms and languages.

Criteria

For this study, Baylor University selected the parameter range of students to be 3rd semester, 150 contact hours, or higher. Tokyo Institute of Polytechnics has selected students from Intercultural Communication Studies who have been studying English for at least 6 years. Students from both universities interacted in L1 and L2 to complete the task.

The Project Time Table

Introductory iVisit session

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[1] L1 is the first language and L2 is the second language. C1 is the culture of the students' own, and C2 is the culture which student is learning as the second culture.

At the end of September 2000, the first iVisit session took place. Baylor class met at 7p.m. to accommodate the time difference of 14 hours. Students answered Pre-Project questionnaires to examine what technological and cultural experiences they have had and how those experiences will change them at the completion of the project.

During this one-hour introductory session, instructors shared the intention and schedule of the project first. Then many students took the opportunity to introduce themselves and asked some questions such as weather, fashion fads, popular music, politics, and other current events. Some questions were prepared and others were spontaneous.

Research in C1

The myth exists among Japanese that folks in Texas still use horses as the main transportation and chases and feeds livestock all day. Then there is a myth among people in the U.S. that Japanese still walk around with katana swords in their sash and drink sake with geisha girls. Although such misunderstanding exists, students have very shallow understanding of their own culture to help others understand the truth. Therefore, in 2000, we assigned students to research in C1 to deepen their knowledge before learning C2 any further. Japanese students took the subject of bushi/samurai while U.S. students researched all about cowboys.

Due to the great number of students involved in this project, the students were divided into six groups; history, jobs, appearances, life style, culture, and beliefs and spirits. By mid October 2000, students posted their research results in assigned rooms on FirstClass server in Tokyo. We chose students to post their messages of C1 in L1.

Read in L2 and learn C2, then post replies in text and video

Students read the posted messages in L2 and learn C2. Then they are required to post a response, including a question, in the mixture of L1 and L2 by the end of October 2000. The interface of FirstClass is very similar to that of many popular email applications. However, the messages are threaded for better organization. In 2001, we added another method of communication using video letters. Two streaming servers, a Quick Time server at Tokyo Institute of Polytechnics and a Real server at Baylor, hosted this project.

Read and post in the mixture of L1 and L2

By middle of November 2000, students have read the comments and questions toward their research. These comments and questions required further research in C1. By this time the communications are getting less formal. Students are developing healthy friendship within their small groups. We encourage students to correspond as much as they prefer.

Concluding iVisit session

At the beginning of December 2000, we conducted a farewell iVisit session. Students from U.S. met at 6 p.m. to accommodate the time difference. (A cultural lesson, meeting time in U.S. changes by one hour, since there is no Daylight Saving Time in Japan.) The excitements filled the both rooms to meet their cyber friends from their small groups and finally put the name and face together. Students answered the Post-Project questionnaires consisting 44 questions, to complete this project.

Five C's

"Culture is not the people but the communication that links them together."

Mary Jane Collier

Our goal is to see how students can learn C2 through their communication in more realistic way through technology. In order to complete this approach, we must consider and examine the Five C's and apply this idea to enhance learning.

In the first C, ***communication***, we use iVisit to encourage and enhance students' speaking and listening skills. In contrast, during FirstClass sessions students applied mainly their reading and writing skills. Many students enhanced their FirstClass presentation with visual and aural communication tools, such as sound and graphic files to deepen the communication.

As mentioned earlier, this project is not only learning C2, but begins from examining C1. This enables the complete reflection and learning of *cultures*. Examining and understanding oneself only enhances understanding others. FirstClass sessions allowed students to examine the myth and find the truth. iVisit sessions filled students' appetite with better understanding of contemporary popular culture.

As students learn another culture in a language class, there is an opportunity to make *connections* to other academic fields. The following chart indicates some of what students had shared and learned throughout the project.

	iVisit	FirstClass
Politics	Discussion of contemporary agenda	Political system from the appropriate era.
History	N/A	Cowboys and Samurai
Music	Discussion on contemporary music	Music that cowboys and samurai listened.
Art	Contemporary fashion fads.	Paintings depicting the appropriate era were shared.
Literature	N/A	Appropriate literatures were shared.
Sociology	Experiencing such traits as tardiness and shyness of students make a reflection to its culture.	Fashion, jobs and other related issues were discussed.

From entire project students received opportunities to make *comparisons*. One way is to compare and contrast now and then. It is done in different subject fields, which we discussed previously as a part of connection. Comparison of C1 and C2 within the particular time occurs concurrently. These comparisons take place during both iVisit and FirstClass sessions.

$$\begin{tikzcd}
\text{Then} & C1 \arrow[r, leftrightarrow] \arrow[d, leftrightarrow] & C2 \arrow[d, leftrightarrow] \\
\text{Now} & C1 \arrow[r, leftrightarrow] & C2
\end{tikzcd}$$

To provide *Communities*, we used iVisit for its visual, oral, and aural communications. This community was a large community where students shared one camera, one microphone and one screen. FirstClass clients were more intimate. It used small groups for the reading and writing communities. Individual involvement became more crucial in this exercise. Yet we realize that a true global community evolves during the project. Both software can be used from anywhere in the world.

These five c's take significant part of this project. Each c depends on each other to make this collaboration effective. Only when these five c's become interactive, this project claims success.

Data

Since the first semester, all of the targeted Baylor students have already been assisted on their language acquisition by computers from their "E-mail Pen pal" programs. However, their change in opinion and attitude toward computer-assisted-learning has not yet been measured until now. Students have and will complete two questionnaires for this collaboration. One must be taken before the project and the other immediately after completion of the project.[2]

Although current result limits in accuracy to determine its outcome from the data of only one project, preliminary data result from Baylor students shows the effectiveness of computer-assisted acquisition. In asking, "Do you think computer is a useful learning tool in academic setting?" clearly there is an increase in recognizing the usefulness and effectiveness in application of technology in education during one semester.

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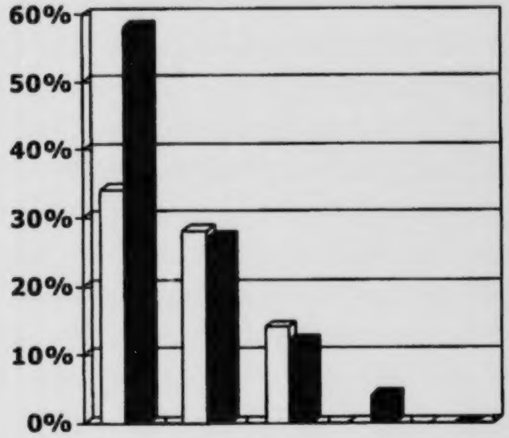
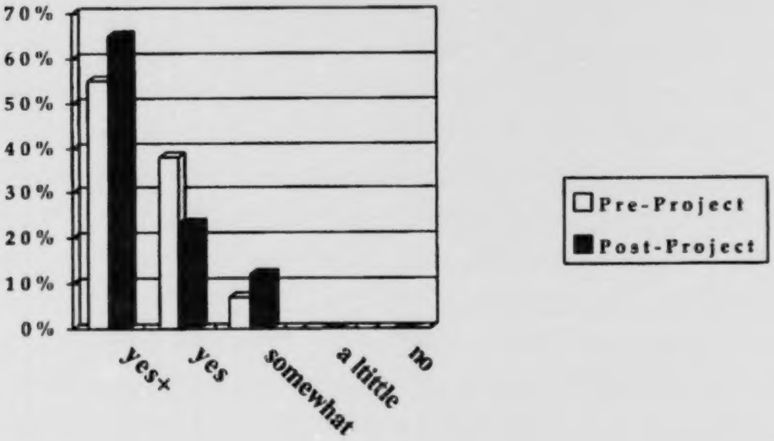
[2] Questionnaires are available for the viewing purpose only at http://www.baylor.edu/~Japanese/interculture.html.



[redacted]

Another interesting question asked, "Are you interested in foreign cultures?" The interest in foreign cultures increased after experiencing this collaborative project. Therefore, as predicted, the technologically enhance culture-learning collaboration place learners in positive and predictable communicative world in which learners must experience to acquire another culture.



On the Japanese side, the questionnaire results show no statistically significant change of attitudes among students. However, quite a few post project comments from these Japanese students tell that they became able to perceive their virtual partners as real persons and build a kind of relationship that promotes learning. The importance of personal relationship for network-based learning programs has been suggested by several Japanese researchers, and this study meets such a claim.[3]

Problems to be solved

As with any project, we can expect some problems. The problem, which we cannot resolve, is the time difference during iVisit sessions. 14 or 15 hours in time difference, depends on the Daylight Savings Time, becomes a menace. Another problem in iVisit session is the poor connection speed. The poor connection speed will result in jerky and dropped video and audio feed. Another result of the poor connection speed is the extreme reverberation of audio feed which disables the recognition of the language.

Limitation in the number of video windows forces us to use only one camera. It would be ideal to have all 30+ students to appear in individual windows. But software issue and connection speed limits us to perform at that level yet.

In FirstClass neither the time nor connection speed raise serious concern. The limitation in number of students who can login simultaneously brings a serious concern. This problem disables to login to FirstClass server as an individual during a class and has discussion on particular postings.

Conclusion

After all, "when we are merely being ourselves, acting according to our deepest instincts, human being reveal fundamental differences in what we all tend to think of as normal behavior." (Storti) Communication errors easily and rapidly occur in our networked life. Strangers from all over the world gather in the online community. Without proper understanding of cultures, the behavior progress inappropriately.

Five c's take an important role in teaching culture in foreign language courses. In the acquisition of language and culture, the technology assists teachers to offer innovative and effective method of educating. Technology aids *communication*, assists to learn *culture* of L2, make *connections* with speakers of the target language, provides *comparisons* between L1-L2 and C1-C2, and offers to participate in *communities* using languages other than L1.

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[3] The importance of relationship building for network-based corroborative learning is discussed in the following books and the article.
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Comparing Different Genres of the Internet in Education

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Abstract*

As technology improves, everyday new devices are developed in more sophisticated ways. This is also true for classroom and teaching tools. If technology is to be integrated into schools successfully, then teachers must understand that instructional technology is not just hardware or software, but rather a process and/or approach to teaching and learning. There are many benefits and barriers of using technology in teaching. First, with the use of technology the lesson can be adapted to accommodate special needs students. Technology helps the teacher individualize the lesson to meet all students' needs. Second, technology also helps make learning meaningful. Through the use of technology learning can be presented in a novel and creative way. When students take personal interest in a topic they begin to take ownership of their newly acquired knowledge. Even though the Internet has many benefits it also has weaknesses with the use of technology. This study is a review of different genres of online educational tools and aimed at elucidating the purposes benefits, and barriers of using different Internet genres.

(*) An initial draft of this paper was submitted as a part of the requirements of the course, EME 5207: Designing Technology Rich Curricula, offered by Asst. Prof. Colleen Swain in the College of Education at The University of Florida in Spring 2001.

Envisioning Use of the Internet in the Classroom

The Internet has been introduced in schools for 15 years; however, it has only been a few years that educators see the power of the Internet in student learning and achievement. The Internet may play various make roles in education. It is the responsibility of the teacher to decide how to best use of the Internet Genres to support student learning. When teachers integrate the genres into their curriculum, they can enhance their lesson. The Internet genres give students access to real life situations, not text book cases. Students sense the difference and are more involved, their learning is more in-depth, because they are using their critical thinking skills, making judgments. This article mainly points benefits and impediments of the Internet Genres for educators. The Internet was originally designed to allocate information in an interactive way and to allow people to communicate with each other and with machines (Bernars-Lee, 1996). It hoped that the following framework sheds light on education in classroom.

Classifying and defining different aspects of the Internet Genres allows teachers to use technology to enhance students' learning, and to improve teaching. However, without an educator who facilitates learning, the richness of Internet in the classroom setting is not effective. March in his article "Working the Web for Education" compares traditional and web-based education (March, 2001).

There are many benefits and barriers of integrating technology in class. First, with the use of technology the lesson can be adapted to accommodate special needs students. Technology helps the teacher individualize the lesson to meet *all* students' needs. Technology also helps to make learning meaningful. Through the use of technology learning can be presented in a novel and creative way. When students take personal interest in a topic they begin to take ownership of their newly acquired knowledge.

Even though the Internet has many benefits, it also has weaknesses. It can be totally useless or less useful than traditional teaching when weaknesses are not understood. One disadvantage of using the web quest format, for example, is that students could get too wrapped up in serendipitous learning. While they could go to a site carefully chosen by the teacher, they can link to other material on that site or other sites that they find personally interesting.

In this article we are going to discuss the purposes, benefits, and barriers of using different Internet genres.

WebQuest:

WebQuests include lesson plans developed and posted by teachers. The plans incorporate the use of the World Wide Web sites and allow for student interaction with the sites in order for them to solve problem and make decisions (March, 1998). [http://www.ozline.com/webquests/intro]. Students are given a scenario and specific tasks to complete to solve a problem or finish a project. Webquests have most of the critical attributes of learning as define by Jonnassen (1997)

Benefits:

- Different perspectives
- Meaningful knowledge
- Promote higher-order thinking
- Afford students the opportunity to practice collaborative thinking and cooperative learning skills.
- Comparing and contrasting
- Motivational
- Student have role to play
- Interdisciplinary & enabling cognitive flexibility
- Involves interactive learning
- Gain more in-depth learning skills
- Teacher (easy format) and student (safe links) friendly

Barriers:

- Time consuming (too much to cover)
- Depends on the maintenance & speed of the network
- Students' adaptation problems
- It might be hard to understand

Online Lesson

Online lesson is a continuous portion of teaching given to a certain number of learners over the Internet.

Benefits:

- Provides access to knowledge that learners need whenever they need them.
- Makes learners more independent and self-responsible.
- Easy to access
- Video and audio formats can add into lesson
- Accommodates multi-model learners
- Enables individual pace
- Easy to update information
- Economical
- Easy to access
- Easy to print presented information.
- Students can construct their knowledge without instructor

Barriers

- Affected by slow and crashing networks
- Need backup plan if not accessible
- Decreases student teacher communication and interaction
- Need content and format preparation
- Motivational factors are not enough
- It is not easy to control learners
- Students can feel lost

Tutorials

- Tutorial is a period of online instruction given by teacher to the learners.

Benefits

- Flexible. It can take place 24 hours a day at learner's convenience.
- Learner can access from any location with the Internet access.
- Economical
- Easy to follow program
- Very easy to present
- Easy to respond questions
- Experiment

Barriers

- Rigid-fixed for one type of learner
- Teacher can not adapt individual
- So much scripted-text based

Simulation

The *Oxford English Dictionary (online 2001)* gives the following definition for simulation: "The technique of imitating the behavior of some situation or process (whether economic, education, military, mechanical, etc.) by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training". Simulation is intended to be discovery learning tool that allows the learner's freedom of exploration by giving learning environments without specific directions or explanations. Simulation occupies very important places in education (Lee, 1999). Simulations provide a unique environment for exploring new concepts, for gaining an understanding of the interplay between related complex phenomena, and for the construction of simplified working models of topics under study. Simulations are also one area in which computing technology is uniquely suited as the delivery mechanism for an educational experience.

Benefits

- Helps students gain understanding
- Allows student to learn by doing
- No risk, no danger
- Rich economical experience, at anywhere, for doing anything
- Allows students to visualize abstract concepts
- Simplification of reference system
- Experience situation
- No consequences, freedom in exploration
- Enables higher-order thinking
- Creativity increases while possible negative reactions decrease
- Control more elements and better
- Mentally active gains
- Multidimensional mental representations
- Address variety of learning styles
- Novel experiences
- Provides a guiding context within which students can integrate what they learn.

Barriers

- Can some times fake
- Not good for multiple uses-contextual
- Can expose violence
- Student imitate action in simulation in the real life-misgeneralization

- Repetition can be boring
- Within presentation mode pure simulation is of low level interaction

Games

The *Oxford English Dictionary (online 2001)* gives a definition of game as below. Game is a diversion of nature of a contest, played according to rules, and displayed in the result of superiority either in skill, strength, or good fortune of the winner or winners.

Benefits

- Has scores reinforcing
- Motivational
- Has fun
- Engaging
- No danger
- No consequences
- Enables higher-order thinking
- Offers big picture view leading to analysis and synthesis
- Communicate players instead of dialogue
- Explore problems and different perspective

Barriers

- More fun than learning
- Time consuming
- Possibility of exposure to violence
- Less control over students
- Repetition may be boring

Telecollaborative: Interpersonal Exchange

Telecollaborative/Interpersonal Exchanges are the structured activities in which students use the Internet tools such as e-mail, chat, and the world wide web to access, process, and share data and to commu nicate, and cooperate. Interpersonal Exchanges include: key pals, global classrooms, electronic appearances, telementoring, question-and-answer activities, and impersonations (Harris, 2001)

Benefits

- Can talk to guest speakers
- Provides multiple perspectives
- Share ideas
- Connect to people outside of classroom around the world
- Bring expert to the classroom
- Generally free

Barriers

- Requires background planning time, preparation takes time
- Needs equipment to practice
- Depend on network

Telecollaborative: Information Collection and Problem Solving

Information Collection and Analysis are the activities that allow students to be involved in collecting, compiling, and comparing different types of information. Information Collection and Analysis activity structures include: information exchanges, database creation, electronic publishing, telefieldtrips, and pooled data analysis (Harris, 2001)

Benefits

- Scientists and students can come together
- Collect data
- Share different data
- Gain access to information from experts
- Apply knowledge in real situation
- Promote higher-order thinking
- Analyze different views, evaluating information
- Includes learning activities

Barriers

- Information is not always evaluated for accuracy, relevance, and currency
- Information may be too difficult or easy for students grade level
- Difficult to control
- Need technological tools
- Limited time, time consuming
- May not be appropriate student level and decide what kind of genres will be fit best to content that is going to teach. The new "representation infrastructures
-

Conclusion

New representative distributed learning tools have both advantages and disadvantages. The incoming information is constantly growing. However, being able to access data and information do not automatically increase students' knowledge (Dede, 1996). Accessing to the Internet Genres does not improve student learning as well. Teachers must investigate both advantages and disadvantages of the Internet genres" brings numerous opportunities for both teachers and learners. However, learners also need enthusiastic, well-educated, and caring teachers, better facilities and equipment. Without removing barriers (such as the learner's comfort level with technology, technical shortage, level of interaction, the level of learner's psychological readiness, cultural/individual characteristics, and environmental factors) in front of the learner, we cannot achieve our goal, which is transformation of required knowledge.

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Safety Strategies While Surfing Online in the Classroom

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Abstract*

Apparently, the Internet has become an indispensable medium of the 21st century. Millions of people are using the Internet for exchanging information, surfing on virtually any topic, communicating with the world, participating in discussion groups, shopping, traveling, and doing many other online activities. The World Wide Web is constantly growing. The Internet offers comprehensive information, instant transactions, communications, and entertainment. The Internet can be used to access reference information such as news, weather, sports, stock quotes, movie reviews, encyclopedias, airline fares, and conducted transactions such as trading stocks, making travel reservations, and banking and shopping online. As an educational tool users have the opportunity to learn virtually anything. Although the World Wide Web can be a world of fascinating and colorful information for students, there are many dangers that children should to avoid, such as sexual, hateful, or violent materials. This paper is a literature review on the Internet safety strategies. The purpose of this paper is to provide parents and teachers some common Internet safety strategies so that they can protect children from the harms of the Internet, based on the literature.

(*) An initial draft of this paper was submitted as a part of the requirements of the course, EME 5207: Designing Technology Rich Curricula, offered by Asst. Prof. Colleen Swain in the College of Education at The University of Florida in Spring 2001.

What is the Internet?

The Internet is a network that connects some hundred millions of users from all over the World. It is a place where not only adults but also children have access to and can interact with a wide range of people. Although the Internet has been in existence for 15 years, the number of the Internet users has reached 127 million and has constantly been growing as seen in figure 1 (Shelly, Cahsman, Gunter, 1999). The Internet is commonly being used for exchanging information, making search in various topics, communicating with the world, and participating in discussion groups, shopping, entertaining, traveling and doing many other online activities. Experience of children with the Internet can be fascinating, colorful, fruitful, and enjoyable. However, there are also sites on the Internet that are inappropriate and uncomfortable for a young audience. Thus, great care should be taken while providing children access with the Internet. School is the most popular access point, with more than 80% of youths between ages 10 and 17 saying they surf the Net at school, according to a joint study by the Kaiser Family Foundation and National Public Radio (figure 2). Almost 63% of U.S. public-school classrooms had Internet access by the end of the year 1999, up from just 14 % in 1996, according to the National Center for Education Statistics. Once they are online, children are may be hooked for hours. Among those who use the Internet, 70% of the students say that they use the Web at least once a week at home or school and 35% report using the Net almost every day. On the average, they spent almost 7 hours per month on the Internet - three hours less than adults (Lake, D.2001).

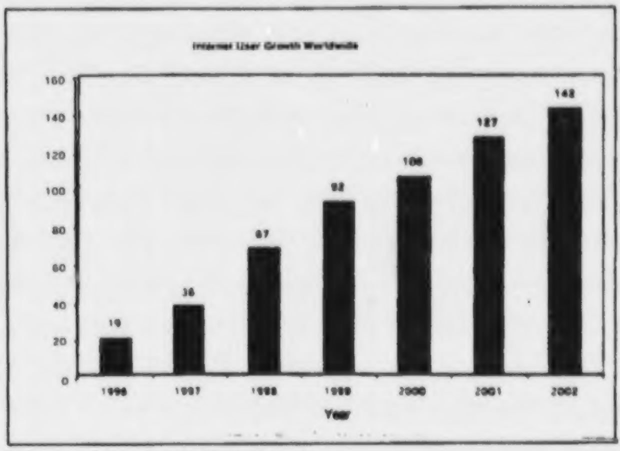

Figure 1. Internet User Growth Worldwide

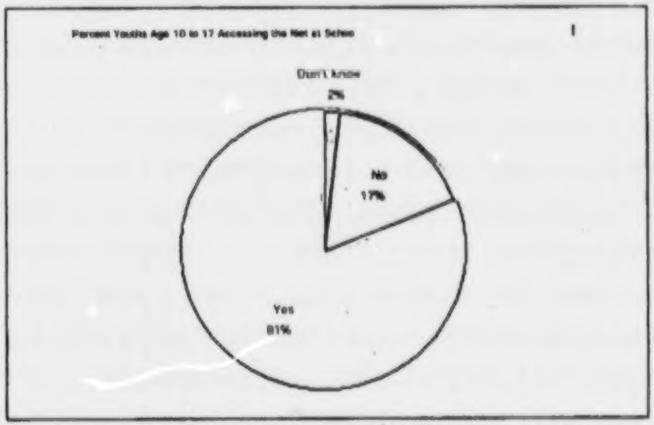

Figure 2. Percentage of Youths Between Ages 10-17 That Access the Internet at School

Using the Internet: Why It is Worth the Risk

There are numerous benefits of using the Internet in the classroom, which would otherwise have been impossible a decade ago. First, the Internet can expand students' access to resources dramatically by making resources from all over the world for them. Second, students can communicate with other students around the world via e-mail, chat, and instant messaging. Communicating each other, sharing information, exchanging ideas and cultures may improve collaborative learning (Newby, Stepic, Lehman, Russell, 1999). Third, students can access graphics, text, data, articles, papers, electronic books, and video and audio clips that enhance their reading, analyzing, evaluating, and higher-order thinking skills. Also, as an educational tool, the Internet allows students to navigate virtually museums, libraries, and places. Finally, students can publish their knowledge and work on the Internet, which is easier and cheaper than other traditional ways of sharing knowledge and cultural values.

How Can the Internet Be Used in Classroom Settings?

There are a big number of ways of using the Internet as a learning and activity tool with which students and teachers may engage for learning and sharing knowledge. People who study in the areas of education and teaching; the Internet is an ideal resource, because text and graphic based communication systems are expanded and evolved into powerful multimedia communications today (Shelly, Cahsman, Gunter, 1999). The Internet and the World

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Wide Web are by providing a variety of learning tools changing the way teachers instruct and the way students learn basic skills and subjects.

There are several ways to use the Internet in the classroom. First, the Internet can be used as a research tool for projects. Students can easily access a wide range of literature on any topic. Second, it can be used for reinforcing topics already covered in class, for example, for expanding the multicultural aspect of the classroom and as a supplementary tool for curriculum or online reading in classroom. Third, the teacher may keep in contact with students and other teachers around the world. The Internet can also be used for practical applications of theories.

What Risks are Involved with Using the Internet in the Classroom?

The Internet is a mirror of the society it is being used by. Currently, web publishing is not controlled by any particular organization and there are no regulations in place to verify the information posted. Although the Internet is a comprehensive information resource and a useful teaching and learning tool for education, there are some areas of the Internet that are not appropriate for a young audience. There are sites that depict nonconsensual act of violence, explicit sexual sites or promote racism, anti-Semitism, and hatred (Magid, 2000). Another risk is that, while online a student may provide information or arrange an encounter that could risk his/her safety or safety of other persons (Magid, 1998). Students have been known occasionally to provide personal identifying information to strangers -either knowingly or not-such as password, home, or school address, phone number that could endanger their mental and physical condition. Also some information, graphics, and video and audio clips acquired from the Internet may not always be accurate and appropriate. Additionally, the Internet can be used as a device with which to play or spend time off task. It is also viable to break numerous laws including "computer hacking" and copyright violation. Educators should preview materials and provide supervision for ensuring children's safe use of the Internet. These strategies and approaches can be different in different circumstances depending on the audience's age, knowledge, and cultural background. Indeed, violence, pornography, and predators on the Web are more serious threats to children's exposure than other threats.

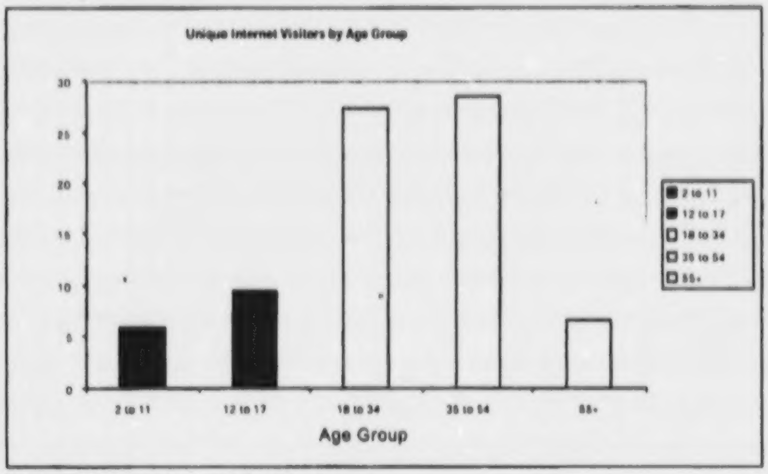

Figure 3. Unique Internet Visitors by Age Group

A recent survey certainly indicates that kids are fueling the Internet explosion. Polling firm Grunwald Associates found in their just-released study that 25 million 2 to17-year-olds are online in the US right now, up from 8 million in 1997.

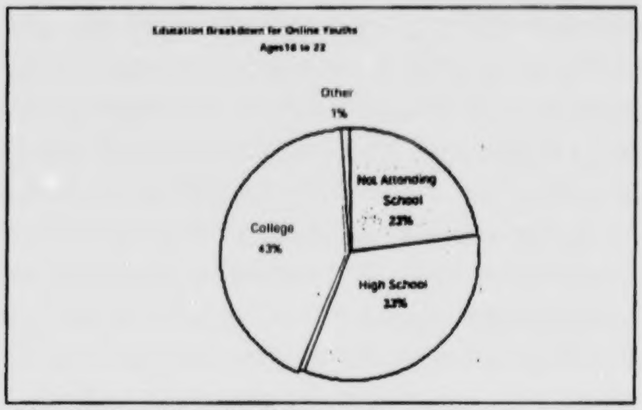

Figure 4. Education Breakdown for Online Youths

About one in five 10 to 17-year-olds surveyed said they have received sexual solicitation or approach via the Internet in the past year, according to a study released this week by the National Center for Missing and Exploited Children (NCMEC). Another key finding was that one in four of the children surveyed said they've had unwanted exposure to pictures of naked people or people having sex in the past year, The study "Online Victimization" available online at www.netfamiliynews.org is an important contribution to the public discourse about the Internet's impact on kids. It calls for "private and public initiatives to rais e awareness and provide solutions," including strategies that reduce the amount of offensive behavior toward kids, help shield parents and teachers from it, and give them the tools they need to cope with both the behavior and its consequences. According to the study large numbers of youths encounter offensive experiences on the Internet. Twenty percent were sexually solicited, 6%were harassed. The offenses and offenders are diverse, not just men trolling for sex. Much of the offensive behavior comes from other youth, and some from women as well. Teenagers are the primary targets, creating a different sort of challenge than would be the case if younger children, over whom parents have more control, were the primary targets. Although most solicitations fail, the sheer numbers are alarming. Several million young people, ages 10 to 17, are sexually propositioned on the Internet every year (Dede, 2001).

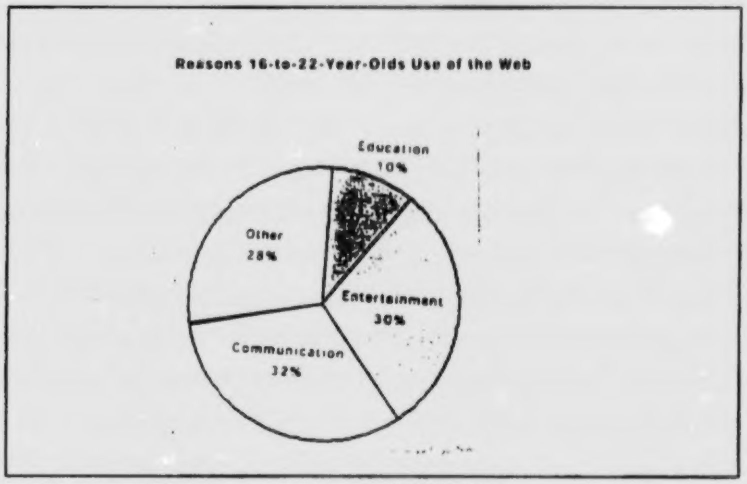

Figure 5. 16-22 Year-olds' Reasons to use the World Wide Web

Safety Issues in The Classroom: What teachers should do

This paper focuses mainly on the safety strategies for 6-12 grade level at schools, because they are thought to be the most affected persons by harms of the Internet. At these grades students are just beginning their move

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toward independence and can no longer be told not to do something without being given a well-argued reason for the rule. At these ages, students need guidelines and assistance with their decision-making. They also need clear guidance for appropriate uses of the Internet, while given information to understand the reasons behind the enforced directions. Careful preparation is the key to effective and safe use of the Internet in the classroom.

Preparing Students

In order for them to be completely prepared fo r navigating the Internet safely in the classroom, students need to learn what defines ethical behavior on the Internet. Essentially ethical behavior on the Internet is the same as ethical behavior in every other aspect of life. Students need to know that they should never menace or harass people they meet online or offline. They also need to know that they should not use language that is offensive to others. A good general rule that the students can fallow is "Don't say anything to people you meet online that you would not say to your parents, teachers, friend, or religious leader".

Teacher preparation

Students need the teacher's support and involvement in learning how to make positive choices. Teaching involves helping students to cope with problems encountered online and providing them with the set of skills, they will need to make the right choices in the absence of their teacher or parent.

There are several ways teachers can prepare themselves and students while surfing online. First, before starting to use the Internet, teachers may give a short lecture about how to use the Internet browser software. Second, to teach ethical behavior on the Internet the teacher may open a discussion about the issue. Opening a discussion, they enable students to think critically about issues as the teacher guides them toward a better understanding. Teachers can also have the students role-play different situations on the Internet or can use examples to help students to come to a better understanding of the issues. Students should be informed of the Internet use policy including the rules of computer use and Internet access. The teacher must make sure that the students have read and signed the Internet Use Policy. Making clear what the penalties are for misusing of the Internet may reinforce students to use the Internet in a proper way. Teachers must also forward the policy to the parents. It is very important to keep parents informed about the activities that the students are involved in the classroom. Sending a newsletter and the Internet and computer use policy, and requiring students to return signed parental forms prior to each semester are some suggestions for teachers. They can also provide a computer workshop for parents prior to each semester in order to allow parents to review both the hardware and software their children will be using. Teachers make their phone number and e-mail address available to all parents to give the parents the ability to contact the teacher with any questions they may have.

Another preparation strategy for teachers is to provide a list of web site addresses that will be used in the class prior to classroom use. Students must be monitored while they are surfing on the Internet. Also filtering or blocking software can be used in the classroom computers to protect students. However, filtering software is practically not often capable of filtering out sites that contain unwanted materials for students. Also sometimes a valid content may be screened out inappropriately. Thus they are not to be relied on completely instead they should be supplemented with other strategies. It is a good idea to make sure computer screens can easily be seen by the teacher in the classroom (Magid, 2000). During an Internet lesson, teachers may roam the classroom observing what students are viewing. Most browsers keep in their history a number of short-term records of the recently visited sites. There are also monitoring systems that provide a record of the web sites a person has visited on the Internet. The monitoring systems and browsers' short-term records are low cost solutions for teachers to monitor their student in the classroom (Dede, 2001). Lacking the awareness of dangers the Internet can pose students unintentionally wonder places where their innocence and safety are compromised.

Safety Rules and Guidelines for Student Classroom Internet Use: What Students Need to Know

The use of school computers and computer networks, computer software, data files, Internet access, and intellectual property in the classroom is a privilege and is intended for educational purposes only.

The following list contains guidelines by according to which students should use the Internet during both their usual class hours and any time they may spend on the school's computers. This lis t is not meant to be a final list of what is or is not acceptable while using the Internet in class; however it provides some insightful ideas. If students are not sure about how to behave in a certain case they should ask their teacher. The set of rules students should obey in class include but are not limited to:

- Share computer account usernames or and passwords except when authorized.
- Create, copy, receive, or use data, language, or graphics which are obscene, abusive, or otherwise inappropriate at school
- Access, change, or delete computer programs, data files or electronic mail belonging to others without permission.
- Steal or destroy school computer hardware or peripherals.
- Steal or destroy computer software or data files owned by the school or others.
- Violate or attempt to violate the security of computer network systems.
- Take unauthorized actions, which deny access to, disrupt, or destroy the service of the computer network system.
- Make unauthorized or unlawful installation of personal computer software on the school computers or networks. Including, but not limited to games, virus programs, and applications software. Student provided software must be used only in accordance with the license.
- Use computers, networks, or peripherals to create a forged instrument.
- Use computers, networks, software, data files, or intellectual property in any unauthorized way.

(This list of classroom rules was adopted from "School Board of Alachua: County District Technology Plan" Available on-line at http://www.sbac.edu/district/techplan.html#anchor16496056, p.12.)

Computer Use Policy in the Classroom

- Computers should only be used for school related, educational activities.
- Chat rooms and Newsgroups may not be accessed.
- Purchases over the Internet are not permitted.
- Student cannot give out information about himself/herself such as personal phone numbers, address, passwords, last and first name, and other identifying information.
- Students cannot send a picture over the Internet or through regular e-mail to anyone without the teacher's permission.
- Student cannot respond to any messages that are mean or in any way make him/her feel uncomfortable.
- Student must tell his/her teacher; if something seems confusing, scary, or threatening online.
- Student cannot have a face-to face meeting with someone he/she has met online.
- Students and teachers will be required to log-in and log-out on the Internet.

(Adopted from "Hidden Oak Elementary School Gainesville, FL" computer use policy form.)

Conclusion

Most educators try to integrate technology and the Internet into classes to enhance students' learning and achievement. Although the Internet is an invaluable resource and a comprehensive research tool, it includes potential dangers and unsafe places as well. The speedy growing use of the Internet in the classroom by students has caused teachers to be increasingly concerned about students' safety using the Internet. The best way to assure that students are having fruitful online experiences is to monitor what they are doing. Teachers should spend time with students while they are online. The next step is to establish some basic rules for students' use of the Internet. While students need a certain amount of privacy, they also need guidance and supervision in their lives. By taking responsibility for students' use of the Internet, teachers can greatly minimize any potential risks of being online.

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Looking for the hype in hypertext: An essay deconstructing pedagogical assumptions associated with online learning and instructional design.

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Abstract

This paper aims to debunk the metaphysics of presence informing modernist pedagogical assumptions. Systematic instructional design, predicated on teleological and eschatological modern metaphysics, superordinates designer's goals at the expense of learners. Tracing structuralist pedagogical theory to Bobbitt (1997) and Tyler (1949), one can readily see the roots of popular instructional design models, such as Smith and Ragan (1993), Mager (1997), and Dick and Carey (1996). If, however, we look to pragmatism and post structuralism, we can find alternatives to reductive and straight-line pedagogical theories and thereby construct emergent and transactional learning spaces in which learner input is valued. Pragmatist and postmodernist pedagogies, moreover, place an emphasis on mediation.

Introduction

The hype is that online, virtual sites will free students, instructors, and administrators from many of the limitations proximal lectures have presented over the years from universal, homogenized pedagogies to reduced infrastructure costs. This paper will examine certain entrenched modernist learning assumptions and counterpoise these with post-modernist and pragmatist sensibilities that seek to take advantage of the current digital revolution in order to improve the educational possibilities for online learning. The emphasis here is pointedly on learning not education as a social institution. As Dewey (1944) noted in the earlier half of the last century, institutionalized education can stifle the natural urge to learn when a society's goals become superordinate to the individual learner's, thereby dampening a learner's desire to grow in an educational context. Typically, instructional design models predicated on fixed objectives seriously limit the likelihood for an emergent learning transaction to occur. The purpose of this paper is to deconstruct many of the underlying pedagogical assumptions informing typical and popular instructional design models, particularly systematic ones, and to offer some alternatives. Using such alternatives will hopefully open hypertextuality to more dynamic potentials for realistic learning.

Modernist pedagogies

The torturous route to Modernist assumptions of knowledge have roots dating back to the Platonic dialogues and Aristotle's philosophical works, through the Neo-Platonists (Augustine) and Medieval Scholastics (Thomas of Aquinas), adopted by such seventeenth century philosophers as Descartes and Newton, and passing through Philosophers such as Diderot and Rousseau. In the modern era, the two most commanding figures influencing curriculum theory and underlying assumptions of knowledge transfer are Bobbitt (1997) and Tyler (1949) (Applebee, 1996; Gress & Purpel, 1979; Flinders & Thorton, 1997; Walker & Soltis, 1986).

Bobbitt's Curriculum

Franklin Bobbitt's The Curriculum(1997) initiated modern curriculum theory (Walker & Soltis, 1986). Bobbitt should be considered what Eliot Eisner (1994) refers to as a rational humanist. A rational humanist believes that foremost, humans are rational animals capable of discerning truth from dedicated and exhaustive empirical study. While this seems a just attitude for determining intelligence at first glance, a more dedicated and exhaustive examination reveals that the rationalist believes that the universe is ultimately knowable if one only discovers certain physical truths. The pseudo-scientific emphasis then resorts to what Dewey (1944) calls the metaphysical fallacy that knowledge preexists inquiry and is fixed with a final end. Even Rousseau's Emile (1962) underscores this faith in ultimate and final knowledge that the enlightened mind can achieve when living in accord with one's natural attributes uncorrupted by society. Dewey critiques this fallacious assumption:

> But the notion of a spontaneous normal development of these activities is pure mythology. The natural, or native, powers furnish the initiating and limiting forces in all education; they do not furnish its ends or aims (p. 114).

The problem with both Rousseau's natural development pedagogy and Bobbitt's social efficiency pedagogy is that they are based on teleological paradigms: for Rousseau, the best education takes advantage of a person's innate abilities as if abilities are a priori and not learned behaviors; for Bobbitt, a society should train future citizens to do the job of today for 30 or more years in the future as if economic and social needs will remain static. Dewey points out just how myopic Bobbitt's social efficiency, structuralist planning model is:

> Industry at the present time undergoes rapid and abrupt changes through the evolution of new inventions. New industries spring up, and old ones are revolutionized. Consequently, an attempt to train for too specific a mode of efficiency defeats its own purpose. When the occupation changes its methods, such individuals are left behind with even less ability to readjust themselves than if they had a less definite training (p. 118).

A social efficiency progressive believes that society can determine what is best for itself and use this knowledge to call upon certain educational reforms aimed at improving the nation. Such assumptions underscored the drive for Physics and Mathematics after the Soviets launched Sputnik and the current emphasis on business training in education so that American educational products can compete in a global market. This underscores education external to a learner, that society determines what is best for the pupil. In contrast, social justice progressives, championed by Dewey, sought expanded democratic participation, social reform, and more equitable wealth distribution. Bobbitt favored preparing students for society, as expert planners perceived it actually existed or would exist. The difference lies in that social justice progressives favored a fluid planning society while social efficiency progressives favored a fixed, planned society.

As Bobbitt (1997) sees it, "the era of contentment with large, undefined purposes is rapidly passing. An age of science is demanding exactness and particularity" (p. 10). Then as now, this stance suggests rigid, external objectives, and standards of learning determined by science. What science meant for educators and politicians then as now is some version of positivism with it presumed "hard facts" along with theory and value neutral inquiry, or what Bobbitt calls investigations "without pre-suppositions" (p. 13). Bobbitt optimistically announced, "Experimental laboratories and schools are discovering accurate methods of measuring and evaluating different types of educational processes" (p. 10). It does not matter that the positivist image of science is theoretically dead; ghoulishly, it lives on to dominate educational practice.

Bobbitt (1997) supposes that aiming for externally expert determined goals, students have the highest likelihood for succeeding and so did the nation. Bobbitt wrote that to "train thought and judgment in connection with actual life-situations" (p. 9), will accomplish his goals. Accordingly, we can deconstruct Bobbitt's basic ideas from the following passage:

> Human life, however varied, consists in the performance of specific activities. Education that prepares for life is one that prepares definitely and adequately for these specific activities. However numerous and diverse they may be for any social class, they can be discovered. This requires only that one go out into the world of affairs and discover the particulars of which these affairs consist. These will show the abilities, attitudes, habits, appreciations, and forms of knowledge that men need. These will be the objectives of the curriculum (p. 11).

It is easy to identify the false social Darwinism embedded in the idea that we should educate social classes for their probable destiny. The "rationality" of social efficiency demands social reproduction. Tracking and the differentiated curricula associated with it serves as a social sorting machine for a society that avoids critical democratic deliberation. As Aldous Huxley (1965) wrote in Brave New World Revisited the social ethic that holds humans as entirely social organisms programmable to social needs as part of a collective hive undermines our humanity, our biological and social uniqueness. Such curriculum planning as Bobbitt advocated presumes such passivity and interchangeability to the socio-economic machine.

Gress and Purpel (1979) remark that Bobbitt's "model of curriculum planning . . . [has] survived a half century's thought and practice in one form or another" (p. 237). Walker and Soltis (1986) write, "The performance-based and competency-based teacher education movement of the 1970's repeated this mode of curriculum construction" (p. 55). The same holds for the "standards" movement over the last decade. The enduring appeal of Bobbitt's objectives and standards approach lies in its putative appeal to modern notions of "reason," objectivity, and measurement. The promise of permanent progress is also modern, though the reductive methodological assurances of a safe and secure, if narrow, path to a perfect and predetermined teleological essence, is pre-modern as is the metaphysics that supports it.

Tyler's "Rationale"

The most influential name in curriculum theory is Ralph Tyler (1949) (Applebee, 1996; Flinders & Thorton, 1997; Walker & Soltis, 1986). Gress and Purpel (1979) note that the "basic elements of" Bobbitt's "work underlie Tyler's classic formulation" (p. 237). The classic work is Tyler's Basic Principles of Curriculum and Instruction (1949). The following excerpt comes from Tyler's "rationale:"

> [F]our major tasks serve as the focuses of curriculum construction: The selection and definition of the learning objectives; the selection and creation of appropriate learning experiences; the organization of the learning experiences to achieve a maximum cumulative effect; and the evaluation of the curriculum to furnish a continuing basis for the necessary revisions and desirable improvements (p. 246).

Tyler focuses on predetermined objectives lying outside the student's activity. Presumably, these objectives are so valuable they must serve as the essential *tools* of all learning. Tyler assumes that concrete and predetermined objectives will make education more efficient and effective regardless of academic discipline; accordingly, Walker and Soltis (1986) state, "Tyler . . . proposes that a school's philosophy be used as a set of standards to 'screen' the objectives derived from this first step in the process. This will ensure that each objective is in harmony with the school's general philosophy and ideal aims" (p. 56). The assumption is that the philosophy of the school establishes the valued objectives for which Tyler has a value neutral tool of means-ends rationality for achieving. This tacitly assumes the old positivist fact versus value dualism as well as the means versus ends one. Most schools, of course, will presume that his methods like most others and most media are value neutral relying on traditional metaphysics' supposition that the ends, the content, are most essential in education.

One should also consider Tyler's (1949) stance on learning experiences. The guiding idea is that of "sequence and integration" (p. 251). Tyler declares,

Curriculum makers can also identify significant skills that are sufficiently complex and pervasive to serve as organizing elements to achieve sequence and integration. And, for objectives involving attitudes, appreciations, interests, and personal commitments, curriculum makers can identify important values that can serve as organizing elements (p. 251).

This is the seductive old idea of *curriculum vitae* as a straight line, secure, and certain method for being safely shepherded through hazardous terrain. While this straight-line approach, with proscribed learning goals as predicated by Mager (1997) and Dick and Carey (1996), makes creating instruction easier, it does little to prepare learners for the unknown realities of tomorrow.

Finally, there comes evaluation to which the code word today is accountability. "I employ the term," writes Tyler, "to include the process of comparing the ideas and assumptions involved in curriculum development with the realities to which they refer" (p. 252). Although he does not say so, evaluation presupposes a philosophical bent since evaluation obviously requires that we reflect on the values we espouse in making our selections of objectives, means for obtaining them, and the organization of those means. What is odd is that Tyler, again implicitly, seems to think he has a value neutral method of evaluation. Things are much the same today.

Commenting on Tyler's rationale, Walker and Soltis (1986) conclude,

> He makes no commitment to certain ideal aims, specific objectives, a particular program, or one conceptualization of curriculum phenomena over another . . . . His commitment is to a highly rationalized, comprehensive *method* for arriving at logical and justifiable curricula of many different kinds (p. 58).

Curriculum is method's child, and content's orphan; the methodological form versus subject matter content dualism is untenable. Walker and Soltis also conclude that the Tyler "rationale" is "the paradigm, the dominant model of twentieth-century thought about curriculum design (p. 55). Nothing has changed in the twenty-first century largely because the Tyler rationale has all the ingredients characteristic of modern thinking, including a firm commitment to "rationality," progress, theory (or philosophy) independence of fact, value neutrality, a profound commitment to an external *tools* as the essence of action, and faith in "method" for arriving at the highest value, the *summum bonum*, the supposedly value neutral content.

Pragmatist and Postmodernist Pedagogical Sensibilities

Dewey's Democratic Pedagogy

In opposition to these rational humanist and social progressive philosophical blinders, John Dewey remarks in *Democracy and Education* (1944), education is growth. Living beings must continue to learn in order to sustain life: "life is a self-renewing process" (p. 9). Education occurs naturally through transaction with others and within environments. Human society seeks to control, guide, and discipline this process in order to sustain its viability: "In directing the activities of the young, society determines its own future in determining that of the young" (p. 41). Hence, society's desire to renew itself, to varying degrees, can be seen as a progression from an individual's desire to sustain him or herself. Dewey problematized his earlier distinction between education and schooling in his reconsideration of *Democracy and Education* (1944), *Experience and Education* (1997). Growth as education occurs naturally as a state of disequilibrium in which an individual attempts to reestablish equilibrium through inquiry.

Schools, as institutionalized loci for disciplined learning, seek to guide this process so that society can continually be self-sustaining. The problem lurking within this neat summation resides in disharmony. When either extreme, subject-oriented education versus object-oriented education, takes precedence over the other, growth is hindered. The pendulum has swung back and forth between the individual's desires and the society's desire since people have debated curriculum. Currently, this is particularly true in instructional design with its overweening emphasis on goals. Dewey maintained that goals are important, but these are goals in view – ideals of what we want to achieve that occur rarely in exactly the way we had initially envisioned. Goals are, therefore, contingent and emergent by nature because reality intervenes changing our goals to fit circumstances and ever-changing contexts.

Foucault's Discipline and Punish

In modernist pedagogies and systematic instructional design models, we see an example of Foucault's concept of "docile bodies," which manifests itself as the science of behavioral control in a clinical environment. "Docile bodies" relates how "modern disciplinary technology does for the human body and the body politic what Newton had done for physical bodies;" in other words, it has created Man-the-Machine; as Garrison & Burton (1995) claim instructional designers all too often presume students are thinking machines and extensions of their tools (pp. 72-3). Moral accountability can now be quantified as a numerical representation, grades; political control thereby manifests itself as the inexorable controlling agent in this utilitarian rationalization (p. 73). As for correct training, Foucault (1979) delineates a tripartite hierarchy of power: hierarchical observation – the teacher constantly monitors student activity exemplified by traditional classroom organization; normalizing judgment – the culture restructuring itself by enforcing student accordance with a hegemonic episteme; and examination – determining if students meet the standardized criteria that de facto reify socio-political norms. Unfortunately, Foucault's (1979) warning that such a system predicated on an all seeing and centralized eye, a panopticon, can come to fruition in this climate. The reliance on a hierarchy sorts individuals as objects into ability categories depending on how well they score on exams developed from norms taken, in turn, as fixed or natural categorization models. Such models assume that the norms are value neutral, but even a cursory glance at the material constituting standardized tests ; one can see that the material is biased towards the hegemonic values of a society's social elites. As Becker (1998) points out, such tests are highly value laden based on the skills that dominant social groups value, and mistakenly taken as raw scores of intellectual ability and gauges for future success – as long the same dominant group defines success.

In a rational world, scientists (social and physical) discover the essential meaning of things, the monad. Latour (1987) remarks how in typical scientific processes, real things are abstracted into laboratory symbols cleansed of interference from the outside world; such abstractions have little to do, however, with the initial thing that actually exists in its environment. In a less rational world, one that is not reduced to the world as a controlled laboratory, essential meaning is a chimera, so why should we base our pedagogies on a worldview that purposefully ignores the richness, diversity, and complexities of what it is to be human caught up in the nebulous sweep of existence? Foucault in The Order of Things: An Archeology of the Human Sciences (1971) provides an answer: because people in power, who claim to discover truth, actually construct it. Foucault writes, "the problem is not changing people's consciousness – or what's in their heads – but the political, economic, institutional regime of production of truth" (p. 133). When we acknowledge that truth is not fixed in an ultimate origin (arche), is not predestined to a specific end (tools), nor has an essential value (monad), we can see that reality (ousia) is contingent on context and one's perspective within a given locus. When this emancipatory vision occurs, we can pull down the edifices that sustain hierarchies, rules, and categories as givens and rebuild pedagogy around concepts of relevance.

Friere's Pedagogy of the Oppressed

Instructional design methods typically rely on specious pedagogical strategies of "facilitat[ing] knowledge transfer," which Friere (1973) critiques as the banking concept of learning. In Pedagogy of the Oppressed, Freire stipulates that humans exist to change the world through dialogue: "To exist, humanely, is to name the world, to change it" (p. 150). Naming the world occurs in transacting with the world. Transaction is a process within a functioning democracy; domination of dialogue, becoming a monologue of the dominator transferred onto the dominated, manifests itself as pedagogical sadism. Tragically, this sadism is the typical instructional design mentality in which the content and content specialist, master the student and correct the student behavior though grades dictated upon how well students retrieve information placed in their long-term storage. Freire claims in the banking concept of education that the teacher deposits knowledge, much like a capitalist would, in order to retrieve his or her funds at a later date, in this case from the student/bank, with interest. The accrued interest, on top of the correct response to the answer, is the student's mindset that he or she is essentially powerless in this exchange. The dividend for the capitalist is proletariat passivity.

Eisner's Three Curricula

Using Eisner's (1994) three curricula – explicit, implicit, and null, – we can deconstruct what Tech intends to promote: explicit, the agenda illustrates desire for responsible, self-sufficient, active learners, who proactively contribute much to their own learning goals and methods; implicit, the methods are designed to make students react to external stimuli in a proscribed manner (e.g. fill-in-the-blanks and multiple-choice), creating passive students given precious little room for critique and analysis, two keys for active learning; null, the content is predetermined and predominate, so little freeplay exists for student discovery—the assumption here is that knowledge is finite, fixed, and ultimately determinable to an absolute value. Tech has pronounced a knowledge-in-action agenda, yet has promulgated a knowledge-out-of-context methodology. The strength of this instructional design is that students tend to do better on conduit model testing, yet their critical analytical skills suffer: "Such a curriculum of knowledge-out-of context may enable students to do well on multiple-choice items. It does not enable them to enter on their own into our vital academic traditions of knowing and doing. They lack the skills to develop interpretation, to analyze a new situation, or to muster evidence in support of new arguments and unexpected opinions" (Applebee, 1996, p.33). The underlying problem resides in the privileged status of the content as the origin, ends, and fixed meaning of knowledge. We are carrying the baggage from Plato's "myth of the cave" where knowledge, episteme, is ultimately and permanently definable to a fixed point—a monad. This, in turn, leads to suspect pedagogical methodologies that emphasize knowledge-out-of-context. Applebee (1996) describes how this mindset affects methods:

> Educators have relied on classroom practices that focus almost exclusively on memory, allowing goals of active reasoning and participation to fall by the wayside. Instead of the knowledge-in-action that both allows and develops through participation in culturally significant traditions of discourse, we have emphasized the knowledge-out-of-context that comes from studying its characteristics (p. 26).

This reliance on a contextualized knowledge may well enable students to do well on multiple-choice and fill-in-the-blank tests, but does precious little to prepare them for a world that does not function in such a reductive manner. Subsequently, this method instills a dichotomous world-view in which students learn that real world decisions can be distilled to either/or solutions that reduce complexity at the expense of creativity.

The task at hand is to find ways to salvage the goals of the academic agenda from the myopic and ill-conceived methods adopted from information technology. In this decade scholars from various disciplines have offered warnings about assumptions inculcated within this transformation (I use this term generously for now because pedagogical praxis has undergone precious little change while the medium has) and propositions for offering students to become more participatory and active learners in the environment. If we give heed to and adopt humanist, post-structuralist, and pragmatic misgivings and sensibilities respectively, we may actually take some meaningful steps towards skilling active participants in a multivocal and participatory democracy – a much more preferable locus in a public university than jumping so readily into bed with market place positivistic assumptions. Specifically, I intend to look at Garrison and Burton's (1995) warnings voiced in "Power, Knowledge, and Hypermedia" and George Landow's (1994) call to move hypertext towards post-modernism delineated in Hypertext: The Convergence of Contemporary Critical Theory and Technology.

Garrison and Burton's Skepticism

Garrison and Burton (1995), in "Knowledge, Power, and Hypermedia" cite Nelson's critiques of scientific learning theories harking back to Taylor and Bobbitt's scientific management models that have resurfaced in current conduct and accountability centered educational models demanding that education emulate the market place. Nelson balks at the oppressive nature of bureaucratic scienticism that often fails to take learner relevance and educational context into consideration. In contrast, Nelson offers his Xanadu concept focusing on open hypertext as opposed to universal hypertext. Open hypertext, simply put, allows users to create their own links and add information to a naturally evolving matrix, whereas a universal hypertext, much like Vannevar Bush outlined in "As we may think," is constructed by specialists bound by fixed hierarchies and standardized rules. In the former case, we have "computer-text-system people" who value everyone's contribution; in the latter case, we have "information Lords" controlling content and access by "information Peons" (p. 71).

Landow and Hypertextuality

Landow holds forth hope that hypertext, hypermedia, and on-line learning environments may accomplish some of the post structuralism goals: "we must abandon conceptual systems founded upon ideas of center, margin, hierarchy, and linearity and replace them with ones of multilinearity, nodes, links, and networks" (p. 752). Landow emphasizes that electronic links create more easily accessible "lexias" to external links increasing the viability for intertextuality. This intertextuality, in turn, helps reduce the status of the author at the expense of the reader: "hypertext blurs the boundaries between reader and writer" (p. 755). Barthes' "readerly text" comes to the fore seeking to create a text for active readership and disestablish the "pitiless divorce" between producer/user, owner/customer, and author/reader to which one may readily add teacher/pupil (p. 755). The non-linear links in a hypertext and the reader's ability to add to the text, involving feedback from other writers, offers a more active role for the traditionally passive reader. The reader/student becomes an active participant in making meaning thereby increasing the relevance and the links to the reality of the transactional, lived experience.

Derrida's Deconstructing of the Transcendent Signified

With respect to Derrida (2000), hypertext offers a text more closely aligned to our lived experiences in which context as the center of meaning takes the place of a contextualized truths or structural centers. A living hypertext is constantly restructured and recentered as the context shifts creating an infinity of new contexts. Hyperpedagogy uses a similar paradigm in which the class – here defined as participants, content, and context in a transactional environment – becomes an assemblage or a constantly mediated montage of meanings. Derrida quotes, "I believe that the center is a function, not a being—a reality, but a function. And this function is absolutely indispensable" (p. 495). By moving the locus of significance from essence to function, Derrida effectively deconstructs the viability of fixed meaning that examination standardization strategies, conduit-teaching models, and panoptic pedagogies that rely heavily on prerequisites and like-minded philosophical assumptions.

Derrida (2000), in "Structure, Sign, and Play in the Discourse of Human Sciences," questions the function of structuralism by deconstructing certain Platonic and Cartesian assumptions regarding the privileged status of structural centers. After Derrida concludes his argument, the validity of the "myth of the cave" from Plato's Republic (1985) and the cogito ergo sum from Descartes' Meditating on First Philosophy (1993) lay in shards. He stipulates that Western philosophy's foundational assumptions, so deeply intertwined within the structure of episteme, need to be seriously revaluated. The center of traditional philosophical structures, at once part of the structure and simultaneously existing transcendently beyond its grasp, are not centers at all. Transcendence is a central tenet in the metaphysics of presence, what Derrida labels the transcendent signified. When we remove the concept of transcendent signified and allow for freeplay, we extend the domain and interplay of signification infinitely (p. 496). As he stipulates, "Freeplay is the disruption of presence" (p. 508). Recognizing that structures are flexible and adaptive to the demands of place and time, ruptures the eschatological belief in epistemology inexorably linked to the ideologies of ultimate knowledge (episteme), origins (arche), and ends (tools). Reality is no longer a discovered monad or essence confined by the alpha of arche and the omega of tools. By admitting freeplay room in our concepts of reality, we can deny the dualities inculcated within the metaphysics of presence: physis/nomos and physis/techne. As Derrida writes, "the whole historical chain which opposes 'nature' to the law, to education, to art, to techniques—and also to liberty, to the arbitrary, to history, to society, to the mind" deconstructs the limitations placed on pedagogues to reconstruct reality and teaching models (p. 499). Derrida, furthermore, writes how deconstruction of utilitarian empiricism will expose the limitations of ideologies invested in fixed, timeless, a contextual truths; seen as tools, however, we can reconstruct reality as a function. By breaking down these dualistic barriers – the supposedly inherent tensions between culture and nature, mind and body, education and nature – fade into irrelevancy.

Regarding the prevalence of dualisms/binaries, Bowker and Star (1999) argue that tensions often arise from globalization of categories. Local categories, meaningful segmentation of the overwhelming myriad of reality, upon becoming universal standards, codified and global, lose relevance to immediate tasks at hand and act as barriers to understanding. Moreover, those who codify global standards take on the mantle of authority and usurp the power away from the recipients of their seemingly arbitrary categories, much like the relationship described by Nelson between information lords and peons.

When we accept that knowledge is neither teleological nor eschatological, we can question the privileged status of the text and teacher, the quintessential classroom authorities. In order to questions the myths surrounding the author, we need to investigate textual possessions. Simply put, textual possessions refers to the fact that most effective (and the most affective) on-line collaboration and instruction occurs as on-line textual communication not as multimedia lectures that emphasize the privileged status of the content and the content specialist. Therefore, poststructuralist theories concerning text, particularly those promulgated by Derrida, Foucault, and Barthes, are especially relevant. Moreover, collaborative work in digital culture should more closely resemble renaissance coteries than the authorial work models predominate in print culture. In coteries the primary method for sharing knowledge was not conduit model – the textbook and professor as the source of static knowledge to be recited much like a litany – but a dialogic one in which the contributors engaged in dialectic *disputation* (Downs-Gamble, 1995). The renaissance manuscript chapbook was mutable, emergent, and co-produced text neither definable to a fixed value nor attributed to a single author. The latter term itself is problematic because its etymology resides in the Latin root *auctores*, meaning the authority on a subject typically referring to a religious subject (Pask, 1996).

Foucault, Barthes, and Authority

Foucault (1997) and Barthes (1998a) deconstruct the concept of author in respectively, "What is an Author" and "Death of the Author." For Foucault the modern conception of author "constitutes the privileged moment of *individualization*" (p. 890). He writes that writing is a *jeu* (game/freeplay) of a writer as part of a matrix: "it is a question of creating a space into which the writing subject constantly disappears" (p. 890). This claim denies the privileged place of author/professor/content specialist/instructional designer as the authority on a particular, set subject or method of teaching. He pits the historical function of author against the modern ideal of author. He writes that historically the author-function exists as four primary characteristics: (1) the author-function is linked to the juridical and institutional system that encompasses, determines, and articulates the universe of discourses; (2) it does not affect all discourses in the same way at all times and in all types of civilization; (3) it is not defined by the spontaneous attribution of a discourse to its producer, but rather a series of specific and complex operations; and (4), it does not refer purely and simply to a real individual, since it can give rise simultaneously to several selves, to several subjects—positions that can be occupied by different classes of individuals (p. 896).

Barthes (1998a) proclaims the death of the monolithic author occurs in the act of writing (*poesis*). Modern concepts of author hinge upon beliefs of univocality and singularity of purpose and knowledge, yet Barthes writes "as soon as a fact is *narrated* no longer with a view to acting directly on reality but intransitively, that is to say finally outside of any function other than that of the very practice of the symbol itself, this disconnection occurs, the voice loses its origin, the author enters into his own death, writing begins" (p. 253). In one fell swoop, Barthes tears down the monolithic structure of autonomous author to reveal the character of writer as practicing a craft within a broad social milieu. The author for Barthes is a production of modern capitalist notions of liability and ownership and a positivist tyranny. The scripter and the text do not exist timelessly but in the *here and now* during and within the acts (*praxis*) of production and reading. The performance occurs in the moment of production and meaning takes shape in the process of reading, never decipherable to an exact essence of the text. Texts have no ultimate meaning tied to "God and his hypostases—reason, science, law" (p. 256). He claims that "Classic criticism has never paid any attention to the reader, for it, the writer is the only person in literature" (p. 257). The death of the modern concept of univocal and authoritative instructor/author gives birth to the active student/reader as both recipient *and* interpreter. The modern authorial, hierarchical stance also predicates discourse surrounding gender and space.

Boler, Massey, and Power Geometries

At an AERA symposium last spring, Boler (2001) spoke on "Real and Virtual Gendered Identities in Educational Landscapes." She writes, "The apparent 'disembodiment' created in cyber culture poses a genuine dilemma for feminist and socially-progressive educators" (p. 1). She declares that the phallocentric conception that the body is central to the production of knowledge and the Platonic/Cartesian stipulation that the body needs to be transcended as an unclean and feminine entity corrupting knowledge and truth dominates discourses surrounding hypertextuality. She juxtaposes her skepticism of cyber culture's claim to be a non-gendered, non-racial, anti-chauvinistic space with Massey's (1993) critique of space anxiety and power geometries.

Massey (1993) in her "Power Geometry and a Progressive Sense of Place" refers to how localities are not as homogenous and local as they appear but are affected by power geometries of local heterogeneous values and global (extra-local) agencies:

> The uniqueness of a place, or a locality, in other words is constructed out of particular interactions and mutual articulations of social relations, social processes, experiences and understandings, in a situation of co-presence, but where a large proportion of those relations, experiences and understandings are actually constructed on a far larger scale than what we happen to define for that moment as the place itself, whether that be a street, a region or a continent. Instead then, of thinking of places as areas with boundaries around, they can be imagined as articulated moments in networks of social relations and understandings (p. 66).

The preponderance of nostalgic spatial language is an aspect of power geometries in which hegemonic influences attempt to contain and limit the chaos supposedly non-spatial and extemporal cyber culture represents. Hegemonic groups use the time/space compression of cyber culture to further entrench the digital divide – women, non-whites, and poor people rarely find access to social and economic power-geometries that white, middle to upper class males do. Internet access alone does not guarantee access to power manifested within cyber culture space. While more women are accessing online spaces, they are often corralled into places that define them as feminine and marginalized from power. The most popular sites, such as girl chat rooms, traditionally gendered spaces like seventeen and cosmo-girl, and online shopping in gendered specified places, reify stereotypical feminine roles. Boler (2001) concludes that "the nostalgia for place, authenticity, and stable identity which Massey recognizes as a masculine nostalgic reaction in relation to time-space compression accurately explains the reinscription of space in digital culture" (p. 4).

Traditional instructional design models tend to see classrooms (localities) as isolated places that exist somehow beyond the confines of a larger reality. Moreover, they regulate the social relationships among participants into strict hierarchies of power and limit networks to homogenous and hierarchical panopticons of power through knowledge transfer from information lords to information peons.

Systematic Instructional Design

Often instructional designers and instructional technologists trained in the use of various modernist learning models, particularly Smith and Ragan (1993), Mager (1997), and Dick and Carey (1996), engineer course transformations from proximal to online. During these transformations, designers often imbrue the course with modernist pedagogical assumptions by implementing one of the popular instructional design models. Traditional instructional design's reliance on the privileged position of goals creates superordinate structures that circumscribe student activity and reinforce fixed domains of knowledge. Smith and Ragan (1993) write that

> Instruction is the delivery of information and activities that facilitate learners' attainment of intended, specific goals. In other words, instruction in the conduct of activities that are focused on learners learning specific things. . . . Every learning experience that is developed is focused toward a particular goal. (p. 2-3)

The student is passive and secondary to attainment of a goal he or she has no voice in choosing or manipulating to meet his or her needs and desires. The learner described in this quotation is a presumptive automaton ready for normalization that leads inexorably to a standardized product ready for the economic machine. We can easily see Bobbitt and Tyler's philosophical assumptions playing in this statement. Moreover, teleological structures that emphasize regulation and particularization of fixed goals reify the power geometry of the designer's privileged status at the expense of both the professor (denigrated to a content specialist) and the student (now little more than content assimilator). This dissemination into fixed roles, additionally, dehumanizes and regulates the process of learning.

Mager (1997) in his Preparing Instructional Objectives also designates objectives superordinate to the learner and methods as beyond the learner's reach:

> you must clearly specify outcomes or objectives you intend your instruction to accomplish. You must then select and arrange learning experiences for your students in accordance with the principles of learning and must evaluate student performance according to the objectives originally selected (p. 1).

The outcomes and methods belong to the instructional designer; Mager assumes student as recipient of content he or she has no choice and by methods in which he or she has no voice. Furthermore, only one set of learning principles seems to exist – in this case a form of reductive behaviorism. One can also note the frequent use of the imperative of his own instructional design. No room is given for any emergence, transaction, or adaptation to change that frequently happens in the emerging reality of the classroom: "instruction is only successful to the degree that it succeeds in changing students in desired ways" (p. 13). The presumption of student as automaton is naked here; moreover, the instructional designer defines success for the learner.

Arguably, the most popular instructional design model, often unquestioned as the instructional design model, is Dick and Carey's (1996) The Systematic Design of Instruction. With its emphasis on being systematic, such hierarchical statements should not surprise one: "The first step in the model is to determine what it is that you want learners to be able to do when they have completed your instruction" (p. 5). While their belief in pedagogical ownership is not nearly as blatant as Mager's (notably one of the theorists informing the design), the next quotation is telling in how little pedagogical freedom they afford the learner: "you will determine step-by-step what people are doing" (p. 5). Here the modern, mechanistic nature of systematic design is laid bare. Traditional instructional design clearly follows in the footsteps of Bobbitt and Tyler.

Conclusion

To return to the plea for finding a means between extremes, we should consult Garrison's (1997) Dewey and Eros. Garrison, harking back to both classical Greek and Deweyian concepts of education, argues that modern education lacks eros, defined here as the passionate desire to achieve an ends. Clearly, the emphasis resides in relevance, but whose is a seemingly unsolvable conundrum in most modern, bureaucratic educational theorizing. Often we rely on dichotomies such as who comes first in choosing the curriculum: the student or the teacher? Do we pass off one person's desires as the only appropriate ones , which are typically cloaked as objective, value-neutral standards, or do we pander to students' desire without teacher guidance, much less supervision? If we, however, look for the common good, what we often call the teachable moment that is emergent and co-constructed, we can avoid this false dichotomy, this destructive either . . . or logic. In doing this, we must pay more than lip service to this noble goal.

In Curriculum as Conversation, Applebee (1996) states that often a discrepancy between "grand goals of exploration and discovery" unfolds and how the class is administered (p.21). If the teachable moment becomes a didactic game of "guess what I'm thinking" in which the teacher's knowledge or answer is more valuable than the student's, then we are lamentably back to a pedagogy of the oppressed cloaked by constructivist buzzwords. We are practicing pure reasoning, a deductive and self-enclosed quest for certainty, as opposed to practical reasoning that seeks ends we desire to obtain. The means, a constantly negotiated center within a fluid structure, exists somewhere between these extremes. The most appropriate way to accomplish this shift away from pedantic pedagogy is to accept students' voices as relevant within their educational trajectories. Regarding curriculum as conversation, Applebee writes,

> Schooling should be organized to help students enter into culturally significant domains for conversation, themselves representative of broader cultural traditions of knowing and doing. By placing the emphasis on entry into such conversations, I seek to ensure that students will emerge with knowledge-in-action rather than knowledge-out-of-context (p. 49)

To do this we need to accept that knowledge is dynamic rather than static and that a means between student and teacher desires discerned through an emergent and mediated transaction will yield fluid and adaptive hyper-pedagogies.

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Designing Web Resource Learning Activities

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Web based instruction often fails to utilize its most unique capability, resources found on the web itself. All too often, lists of URLs are posted with the hope that somehow they will promote learning. Web resources are best utilized when appropriate learning activities are designed to make them an integral part of the learning process. Designing appropriate web resource learning activities requires an understanding of web resources and an application of basic instructional design principles.

The web offers an extensive collection of sites on nearly every topic. Some sites are outstanding, others mediocre at best. Some are interesting and engaging others dull and boring. Some sites are authoritative, others just plain inaccurate.

The first step in utilizing web resources is to find appropriate sites. An appropriate site should contain accurate information related to course content that can be incorporated into a learning activity. Finding good sites requires good searching techniques, discernment, and persistence.

One of the simplest web resource learning activities to help an instructor begin using web resources is a student site search activity. The goal of the activity is to have students find, describe, and share websites related to specified topics. Students will need to know web searching skills and how to evaluate websites. The assignment requires students to post an annotated link to the websites they find on an electronic discussion board. The activity will provide students with relevant course information and instructors with a list of potential websites for future web resource learning activities development.

Once a collection of appropriate web sites has been located, learning activities can be developed that utilize the sites effectively. Some sites provide context for course topics. Others provide good factual information. Some help with concept development, and others provide opportunities for students to analyze and synthesize information. From an instructional design perspective, websites can be thought of as existing materials that can be utilized to meet course outcomes. The key is to match the inherent characteristics of the site(s) to the types of learning activities needed to meet course outcomes.

In keeping with good instructional design, all web resource learning activities should have an introduction, an assignment, and links to the web sites for the activity. While each of these components is specifically tailored to each activity, there are some general characteristics. The introduction should provide context for the activity, motivational elements, and guidance for accomplishing the outcomes targeted by the activity. The assignment should be a natural by-product of utilizing the site that verifies participation in the activity. The links should be appropriate and durable.

A collection of interesting sites with a broad coverage of course topics can be used to create an information exploration activity that provides context for course topics. The introduction should explain how that the activity provides background and context for the main topics in the course. The assignment provides a means to insure that students complete the activity. It may be as simple as having them report on their findings, or it may require them to relate what they discovered to a key topic in the course. The web sites need to be engaging. They should appeal to student curiosity and be visually pleasing. Include sites on a wide range of supplemental topics. Each site should also have a broad coverage of topics on the site.

A knowledge acquisition activity is a good way to help students find important factual information for the course. The activity introduction should motivate students by explaining how the information is related to course outcomes, and that it is not just "busy work." Knowledge acquisition activities should include questions that focus on specific facts relevant to the topic at hand. The goal is to direct students toward the information they need to know about the topic. The assignment should require the students not only to have visited the sites to gather the facts, but also to utilize those facts to accomplish the assigned task. The sites for the activity must contain the factual information necessary to answer the topic-related questions. Look for sites that focus on the topic and provide information not included on other sites. Try to cover the topic with a minimal number of sites.

Web sites often provide the examples necessary for a concept development activity. The introduction to the activity should focus on the key elements of the concept being learned. The assignment should provide the students with an opportunity to demonstrate that they have a clear grasp of the concept. Several sites that clearly demonstrate the attributes of the concept or that are obvious non-examples of the concept should be used.

A knowledge generation exercise directs students to sites containing information related to a specific course topic. The assignment in the exercise requires that the students analyze the information they find. They are then required to synthesize that information and generate a new representation of that knowledge. Knowledge generation forces students into inquiry and higher order thinking. It is often appropriate to utilize collaboration between students to provide multiple points of view. The activity introduction should arouse the natural curiosity of students by focusing on the controversial or challenging aspects of the activity. The assignment should provide the students with the opportunity to create a document, presentation, or other means of communicating the ideas they have generated from the information they have learned. Look for sites with divergent opinions about the topic that force students to think critically. Provide enough sites to present all of the major aspects of the topic.

Web resources can provide effective learning activities. Appropriate selection, design, and utilization will optimize the use of those resources and make them an important part of your course.

LEARNING AT A DISTANCE in South Dakota: Description and Evaluation of the Diffusion of a Distance Education

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Background: Distance Education in South Dakota

The fall of 2000 has brought broad new opportunities to K-12 education in South Dakota. Beginning on August 15, 2000 interactive videoconferencing classes began to be sent over the Digital Dakota Network (DDN), a state-wide telecommunications network connecting all 176 school districts in the state. The DDN provides schools with free Internet, videoconferencing and e-mail. Although the DDN and statewide videoconferencing is new to South Dakota, regional video conferencing within the state is not.

As early as 1994 classes were offered over the North Central Area Interconnect (NCAI), a video consortium of eight schools in the northeast part of South Dakota. An advisory committee made up of one principal from each district advises the governing board of the NCAI. The governing board who actually makes the decisions is composed of a superintendent from each district. It is estimated that the original development of the NCAI system cost $1.3 million. A portion of the funding came from a Rural Electrification Administration grant with the member districts providing the remainder of the startup costs. Member schools presently pay $11,000 a year membership fee and educators teaching over the system are given a $450 stipend a semester.

Early class offerings on the NCAI included Spanish and Lakota Indian Art. NCAI has continued to expand their course offerings to students and by the spring of 2000, NCAI was in a situation where they were contemplating adding an additional videoconferencing classroom to meet their student curricular needs.

Lloyd Trautman, a physics teacher on the NCAI, and his wife, a Spanish teacher over the network, have been teaching on the system since the first year. Lloyd was among distance education's' harshest critics when the NCAI started. Today Lloyd is one of distance education's strongest advocates in the state because of his experience and the benefits of distance education that he has seen firsthand. In a school with an enrollment of 100 students in grades K-12, distance education has met a variety of needs that would never have been possible. The NCAI schools have experienced the benefits of distance education

A second video consortium, the Sanborn Interactive Video Network (SIVN), began offering classes in January of 1996. This consortium of six K-12 schools, a private university, and a technical institute, utilized a Rural Utilities Services (RUS) grant to fund a portion of the startup costs to establish their network. Member schools pay $3,000 a year for maintenance and administration of the system. A $400 stipend is paid to individuals teaching a course over the network. The SIVN presently offers seven classes over the system and has a seen an increase in participation each year. More information on the SIVN can be found at: http://mti.tec.sd.us/teleport/sivn.htm

The Southeast Interactive Long Distance Learning (SILDL) started offering classes in the fall of 1998 to its 11 member schools in the southeast corner of the state. A portion of this million-dollar system was paid for by a RUS grant. Members pay $3,000 a year to cover administration of the system and pay a $500 stipend to educators that teach over the system.

The SILDL started with 9 classes and 100 students and within two years is offering 15 classes to 225 students. This consortium has also been in a position of needing to add a second video classroom to cover the demands of the member schools. The principals and superintendents of the member schools have regular meetings where they indicate which classes they are able to offer and which classes they need. Additional information on the SILDL can be found at their website: www.usd.edu/sildl.

A fourth video consortium, the East Central Interconnect (ECI), started classes in the fall of 1999. The ECI received a RUS grant which provided a strong start for the funding of this million-dollar system. Teachers on the ECI are paid a $600 stipend per semester of teaching. A school board member from each of the 10 member schools governs the ECI. They receive advice from two advisory groups of representative superintendents and principals. The ECI offered nine classes to 119 students its' first year and eight classes to 131 students during the 2000-2001 school year.

All four of these consortiums provide their teachers with training on equipment and strategies on teaching at a distance. Each has developed policies that govern the activities of each consortium. All have felt that their choice to try videoconferencing as a means of distance education for their students was a wise decision and investment.

Additional initiatives by other districts have also occurred. Two consortia of K-12 schools are in the planning stages of implementing a video network. Two independent school districts have also purchased video conferencing equipment which they have used over the last two years to connect their students with resources inside and outside the state.

In 1994 a satellite network, the Rural Development Telecommunications Network (RDTN), was established across the state. It consists of 18 two-way audio/video studios located throughout the state at universities and technical institutes. In addition, 80 downlink sites located primarily at school districts were connected to the RDTN. These sites have one way video/two-way audio. Use of the RDTN network is on a fee per use basis. The RDTN has provided South Dakota citizens with the opportunity to experience the opportunities that a two-way audio/video system can provide a large geographic region like a state.

This network has been used widely by government, education, and health organizations to provide information and training. The RDTN satellite downlinks have also provided a vehicle for several rural schools in the state to receive high school Spanish and Chemistry. Many districts have taken advantage of these classes which they would otherwise not been able to offer their students.

Distance education at the higher education level in the state began in 1914 at South Dakota State University with extension activities, and in 1915 the University of South Dakota began offering correspondence courses. The six state universities have taken advantage of the two-way audio/ one-way video capabilities of the RDTN to offer courses to college level students and to offer dual credit to high school students.

More recently, Governor William Janklow allocated funds to each of the five state universities to establish a "smart classroom" or a Governor's Electronic Classroom (GEC). Each classroom contained individual computer workstations and video conferencing equipment. The GECs provided high tech classrooms for universities to provide instruction at distance.

On July 1, 2000, the Electronic University Consortium (EUC) of South Dakota officially began operation. This consortium is intended to leverage the state's technology investments and make effective use of the unique strengths of each public university to better serve the people of South Dakota by coordinating off-campus distance education across the South Dakota System of Public Higher Education. This consortium was made possible through legislative action during the 2000 session which made funding available for staff to coordinate the consortium's activities.

In the fall of 2000, the higher education institutions in the state are offering distance learning opportunities via the internet, satellite, videocassette, public television, and correspondence. With over 700 South Dakota college students enrolled in multiple institutions within the state taking distance education courses during the fall 2000 semester, the face of higher education in the state is also changing.

Since 1995 Governor William Janklow has slowly and very carefully built a robust technical infrastructure across the state of South Dakota. In 1995 he initiated the Wiring the Schools (WTS) project which put three computer drops for every four students in every classroom, pulled Cat5 and fiber optic wiring throughout the schools, and upgraded the electrical wiring to manage the greater electrical demands of numerous computers. (See accompanying article regarding WTS.) The work of WTS included all public school classrooms, private schools, public libraries, and both public and private university classrooms and dormitories.

In the spring of 1999 Governor Janklow announced a second statewide initiative, Connecting the Schools (CTS). This initiative built a statewide intranet among all 176 school districts bringing T1 access into every public school building K-12. High-end two-way audio/video systems were put into almost every public high school and freestanding middle school. (See related article on CTS.) The Connecting the Schools project built upon the efforts of Wiring the Schools project, establishing a statewide network called the Digital Dakota Network (DDN). The Internet access and e-mail services provided via the DDN are free to all public schools. Video conferencing connections made within the state are also provided free to all schools.

Even though a huge investment has been made in the infrastructure of the DDN, Governor Janklow has always recognized the necessity of developing human infrastructure as well. During the 2000 session, the South Dakota Legislature created a new office within Department of Education and Cultural Affairs called the Office of Educational Technology. According to Section 4 of House Bill 1257, the Office of Educational Technology's "exclusive role shall be assisting local school districts in using educational technology. Its purpose shall include researching, analyzing, procuring, and distributing programs and methods using educational technology in South Dakota K-12 schools and classrooms." The office consists of a program manager, four technology integration specialists, the Department webmaster, and clerical support. The technology integration specialists provide direct assistance to districts and individual teachers on the use of the videoconferencing equipment and instructional strategies. The assistance these specialists have and will provide districts will be one of the keys to the successful utilization of the DDN.

In addition to the technical assistance provided to schools, quality, long-term professional development was also provided. In the summer of 2000 a Distance Teaching and Learning (DTL) Academy was made available to South Dakota educators. This academy was modeled after the Technology for Teaching and Learning (TTL) Academies already implemented in the state (see related TTL article).

Two sessions of this three-week academy were held at a state university with about 130 teachers in attendance. Participants focused on the basics of operating the video conferencing equipment and adapting curriculum for distance delivery. (See related article on the DTL Academies.) With six of the VTEL LC5000s bridged together during the academy, participants were able to practice in a "live" situation. This academy has follow-up opportunities for participants throughout the school year utilizing the DDN's videoconferencing capabilities. Subsequent DTL Academies are being planned so that they are delivered during the summer at school district locations utilizing the powerful capabilities of the DDN. Daily virtual guest speakers who are experts in the field of distance education will be brought to all the academy locations via videoconferencing on the network.

Recognizing that others across the nation have developed expertise in distance education, Governor Janklow wanted to capitalize on those learnings. During July of 2000 the Governor convened his first "Governor Janklow's Capital City Conclave on Distance Education" for which he invited 12 national leaders in distance education to the state capitol for two days to discuss the issues and potential of distance education for a rural state like South Dakota. (See accompanying Conclave article for agenda and participant information.) United State's Senator Tom Daschle was a virtual guest of the Conclave, addressing participants via videoconference from Washington D.C.

In addition to the national guests, the Governor invited 40 state leaders to be a part of the Conclave discussion. It was important that leaders from various state constituencies understand the advantages and potential of a statewide videoconferencing network. The Governor gathered input from these ambassadors on possible next steps for the state. Follow-up with these ambassadors is planned.

Recognizing that the DDN will cause a greater demand for technically skilled people to maintain the network, the Governor has campaigned heavily to make Cisco Networking Academies available in most school districts. During the first year of this effort, 32 Cisco labs have begun to offer networking coursework to junior and senior high school students. Funding for some of these labs has been made possible through the State's Department of Labor. Additional school districts are being encouraged to apply for funding to obtain their own Cisco labs building capacity throughout the state.

Through the efforts of many, led by a very committed Governor, South Dakota is in a position to provide distance education opportunities to every community and citizen in the state. The robust Internet connections and video conferencing capabilities provided by the DDN make many distance learning options available to South Dakota learners. Quality professional development and technical assistance to schools will further encourage the appropriate and effective uses of the DDN to expand learning opportunities across the state.

Evaluation: Distance Education and South Dakota

> "In order to plow straight rows, the farmer does not look down at the ground but at the end of the field."

One major component of the efforts to promote the use of technology and distance education in South Dakota and specifically of Phase III of the *Connecting the Schools Project* was a comprehensive evaluation activity. The process of evaluation included active participation in the project by evaluators, collection of quantitative and qualitative data and submission of several comprehensive evaluation reports. A baseline report was completed and published in March of 2000. This baseline report established a foundation for subsequent evaluation activities. A second report included data collected since the baseline report.

The overall evaluation plan was built around the AEIOU approach (Fortune & Keith, 1992; Sweeney 1995; Sorensen, 1996). The effectiveness of this approach has been demonstrated during its use evaluating the activities of the Iowa Distance Education Alliance, Iowa's Star Schools Project (Simonson, 1995; Sorensen & Sweeney, 1994), a multi-year state-wide distance education activity. Additionally, the model has been used to evaluate a number of other innovative projects such as the Iowa Chemistry Education Alliance (1995), the Iowa General Chemistry Network (1994), and the DaVinci Project: Interactive Multimedia for Art and Chemistry (Simonson & Schlosser, 1995).

The AEIOU evaluation process provides a framework for identifying key questions related to the project's implementation. The AEIOU model is a dynamic one that permits the professional to tailor the process of evaluation to the specific situation being studied. This approach has five components that permit examination of the Phase III of the *Connecting the Schools Project* from a number of different perspectives.

Component 1 - **Accountability** - Did the project planners do what they said they were going to do?

This is the first step in determining the effectiveness of the project and is targeted at determining if the project's objectives and activities were completed. Evaluation questions center on the completion of specific activities. Additionally, counts of numbers of people, things, and activities are collected.

Methods Used: Accountability information was collected from project administrative records. Project leaders were asked to provide documentation of the level of completion of each of the projects goals, objectives, and activities.

Component 2 - **Effectiveness** - How well done was the project?

This component of the evaluation process attempts to place some value on the project's activities. Effectiveness questions focused on participant attitudes and knowledge. Evaluations were used to collect reactions from participants of workshops, academies, and other project activities.

Methods Used: Standardized measures are used to determine program effectiveness. Teachers are asked questions related perceptions about the appropriateness of the *CTS Project.* Focus groups were conducted and participants were systematically asked to respond to questions about the project.

Component 3 - **Impact** - Did the project make a difference?

During this phase of the evaluation, questions focused on identifying the changes that resulted from the project's activities, and were tied to the stated outcomes of the project. In other words, if the project had not happened what of importance would not have occurred? A key element will be the collection of longitudinal data at the beginning, middle, and end of the project.

Impact is extremely difficult to determine because determinants of impact vary. Data were collected at the beginning of the project, during its implementation, and at the end of the first full year of activity.

Methods Used: Qualitative measures such as interviews, focus groups, and direct observations will be used to identify the project's impact.

Component 4 - **Organizational Context** - What structures, policies, or events in the organization or environment helped or hindered the project in accomplishing its goals?

The focus of this component of the evaluation was on identifying those contextual or environmental factors that contributed to, or detracted from, the project.

Methods Used: Organizational context evaluation used interviews of key personnel, focus groups made up of those impacted by the program, and document analysis that identified policies and procedures that influenced the program. Direct participation in program actives by the evaluator also permitted direct observation of events.

Component 5 - **Unanticipated Consequences** - What changes or consequences of importance happened as a result of the project that were not expected?

This component of the AEIOU approach identifies unexpected changes of either a positive or negative nature that occurred as a direct or indirect result of the project. Unanticipated consequences are a rich source of information about why some projects are successful and others are not. Central to the measurement of unanticipated outcomes is the collection of ex post facto data.

Methods Used: Interviews, focus groups, journals, and surveys that asked for narrative information were used to identify interesting and potentially important consequences of implementing the *CTS Project.* Evaluators interacted with project participants on a regular basis to learn about the little successes and failures that less sensitive procedures overlook. Active and continuous involvement by evaluators permitted them to learn about the project as it occurs

DIFFUSION OF INNOVATIONS

Distance education is a new idea in South Dakota. More accurately, distance education is an innovation in South Dakota. Distance education is defined as:

Institution-based formal education where the learning group is separated and where telecommunications technologies are used to connect learners, resources, and instructors (Simonson, et. al., 2000, p. 10)

Specifically, in South Dakota distance education uses a technology -- compressed video -- that permits two or more sites to connect to one another for the synchronous sharing of video and audio. Compressed video is a television technology that has traditionally been used in corporate training, but increasingly is being used in K-12 education. Live, two-way video based instruction is a main strength of compressed video. In 2000, compressed video is considered by most to be an innovation.

An innovation is an idea, practice or object that is perceived as new. Innovations are introduced into organizations and either are adopted or rejected (Rogers, 1995). This process is called diffusion. Diffusion of an

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innovation is the process of communication through certain channels over time among the members of a social system. There are four main elements of diffusion:

Innovation

An idea, practice or object that is perceived as new by an individual or other unit of adoption.

Communication Channels

Process by which participants create and share information with on another in order to reach a mutual understanding.

Time

Dimension in the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection.

Relative earliness/lateness with which an innovation is adopted.

Rate of adoption – number of members of the system that adopt the innovation in a given time period.

Social system

A set of interrelated units that are engaged in joint problem solving to accomplish a common goal.

With a technology innovation, such as distance education, there are two components: (1) Hardware: defined as the tool that embodies the technology as a physical object and, (2) software, consisting of the knowledge base for the tool. The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption (Rogers, 1995). The five attributes of an innovation are:

1. *Relative advantage* is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. It does not matter so much if an innovation has a great deal of objective advantage. What does matter is whether an individual perceives the innovation as advantageous. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption will be.
2. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible. The adoption of an incompatible innovation often requires the prior adoption of a new value system, and this is a relatively slow process.
3. *Complexity* is the degree to which an innovation is perceived as difficult to understand and use. Most members of a social system readily understand some innovations; others are more complicated and will be adopted more slowly. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings.
4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible. Ryan and Gross (1943) found that every one of their Iowa farmer respondents adopted hybrid seed corn by first trying it on a partial basis. If the new seed could not have been sampled experimentally, its rate of adoption would have been much slower. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.
5. *Observability* is the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Such visibility stimulates peer discussion of a new idea, as friends and neighbors of an adopter often request innovation-evaluation information about it. Solar panel adopters often are found in neighborhoods in California, with three or four adopters located on the same block. Other consumer innovations like home computers are relatively less observable, and thus diffuse more slowly.

In South Dakota, distance education using compressed video is an innovation that is being introduced into the state. The success or failure of this innovation will largely depend on the process of diffusion that occurs. Diffusion of innovations sometimes occurs naturally, without the need for outside intervention. Often however, diffusion is managed and facilitated by change agents who involve opinion leaders who provide the necessary impetus for an innovation to reach what is called critical mass. Critical mass is the point at which an innovation spreads and expands without the need for outside intervention.

In South Dakota, the change agents who are guiding the spread of distance education are a group of educational leaders and state department staff. This group identified opinion leaders and trained and oriented them through the use of workshops and academies. The group of opinion leaders has and will provide instruction and support to South Dakota teachers who in turn will guide children and young adults to successfully use the innovation of distance education.

In summary, the diffusion of distance education in South Dakota schools is a process involving an innovation (DDN; compressed video), using communication channels (Workshops and Distance Teaching and Learning Academies), over time, within a social system (the educational community of South Dakota). The evaluation activities described next were conducted to provide educational leaders (change agents) with information to assist them in reaching critical mass, the point at which distance education is widely accepted.

EVALUATION ACTIVITIES AND RESULTS

The goal of this evaluation effort is to provide leaders in the state of South Dakota with quantitative and qualitative evaluation information about the implementation of the distance learning infrastructure phase of the Connecting the Schools project. Evaluation focused on the analysis of the relationship between the distance education training and diffusion of the distance education innovation into the K-12 environment. Factors that were of special interest to the evaluation included information about the innovativeness of those individuals involved in distance education in South Dakota, and the innovativeness of educational organizations in the state. This information helped to explain why educators and organizations were accepting or rejecting distance education, and provided insight into how the process of diffusion of this innovation can be facilitated.

Evaluation Activities

The following activities were part of the South Dakota evaluation plan. First, a standardized questionnaire, called the Connecting the Schools Questionnaire (CSQ) was systematically developed. This questionnaire included four sections – demographic information, a measure of personal innovativeness, and measure of organizational innovativeness, and questions related to distance education.

Second, the CSQ was administered to participants in six workshops for opinion leaders that were held for educators to provide them with skills and knowledge related to distance education. Staff from the Department of Education and Cultural Affairs (DECA) conducted these workshops. In addition to completing the CSQ, participants at these workshops had the opportunity to respond to open-ended questions. These questions were included in the evaluation to give workshop participants the opportunity to express their opinions about distance education.

Third, participants at Technology Teaching and Learning (TTL) Academies and Distance Teaching and Learning (DTL) Academies were asked to complete the CSQ. For these groups the CSQ was made available in an on-line version, so they could respond via the Internet. The participants at the TTL and DTL Academies also had the opportunity to give open-ended statements. Additionally, a modified focus group activity was conducted with participants of one of the DTL academies. Attendees were asked to respond to three questions about distance education in the state.

Finally, a random selection of South Dakota teachers was sent the CSQ. Their responses provide a basis of comparison. They represent the "average" South Dakota educator. This group also provided open-ended comments about technology and distance education.

Conclusions

Based on the results collected from the CSQ and from focus group activities the following conclusions about South Dakota's *Connecting the Schools – Phase III* Project can be made.

Component 1: **Accountability** – Did the project planners do what they said they were going to do?

It is obvious from data collected, meetings attended, and reports submitted that the *Connecting the Schools Project* – Phase III is being conducted effectively. Distance Teaching and Learning (DTL) Academies were held during the summer, as were six specialized training sessions for opinion leaders. Additionally, a number of meetings, short sessions, and orientations were held, all designed to explain the potential of distance education and the utilization of the Digital Dakota Network.

Component 2 - **Effectiveness** – Will the project be done well?

The effectiveness of the project was measured by the responses from teachers, administrators, network specialists, grant administrators and DECA employees to the training offered, utilizing standardized measures. Questionnaires were given to participants in workshops, and focus groups were conducted with participants.

It is apparent from observations made, data collected, and discussions held that the initial activities of the *CTS – Phase III* project were considered to be effective by participants and leaders. It is obvious that the vast majority of those involved believed that what they were participating in was effective. There has been an interesting lack of criticism of the *CTS project*, even though there have been numerous concerns expressed how distance education will impact on the South Dakota educational community and how overworked educators will be able to effectively adopt this innovation. Apparently, most think the CTS is an effective plan to alleviate concerns about distance education.

Component 3 – **Impact** – Will the project make a difference?

By far the most difficult evaluation concept to ascertain, especially in the short term, is the impact of any project, program, or innovation. Impact can be determined when baseline data are compared to data collected in a year, three years, and five years. Data collected and reported early in a project such as this one establish a framework for determining the intermediate and long-term impact of distance education generally, and more specifically, the DDN with its compressed video classrooms. Of critical importance to determining impact is the evaluation of the diffusion process followed by the educational leaders who manage distance education in the state.

It appears that the impact of the *Connecting the Schools Project – Phase III* has been positive. There is a notable lack criticism of the project; most likely because of the carefully planned, systematic process followed by project leaders. It is important to call attention to the success of process used to diffuse distance education into the educational system of South Dakota. First, opinion leaders were identified and specialized training in workshops was developed for them. Second, a large number of teachers were invited to the DTL Academies where they participated in instruction that was comprehensive, lengthy, and conducted by opinion leaders. DTL Academy graduates became highly knowledgeable and many became committed to the potential positive impact of distance education. Finally, stakeholders outside of the educational community were targeted for information about distance education and the DDN. These efforts broadened understanding in the general community and helped diffuse the innovation.

Component 4 – **Organizational Context** – are the structures, policies, or events in place that will help the project in accomplishing its goals?

Preliminary evaluation results clearly show that the concept of organizational context is critical to the success of the *CTS – Phase III* project. Specifically, these organizational topics have been identified:

Teachers must have staff development to overcome their fear of the innovation.

Teachers need continued support after staff development.

Educational policies that guide school policy will need to be studied and changed where necessary.

Teacher (and by implication, parent and student) fears and concerns will need to be addressed in a systematic and planned manner in order for distance education and the DDN to be widely accepted.

Information collected in focus group sessions provided considerable information concerning organizational context. First, there was reported a high level of general support for distance education, specifically because of the potential for curriculum enhancement. Second, many South Dakota educators said they were fearful of the consequences of distance education. Many groups reported these fears over a number of focus group activities. The fear or apprehension felt by those who must ultimately adopt an innovation such as distance education must be dealt with. It appears that the lengthy training provided in the DTL Academies is an excellent technique that alleviates apprehension. Continued follow-up activities with educators are necessary.

Component 5 – **Unanticipated Consequences**

A number of unanticipated activities occurred – the most significant was a special meeting held in Pierre, SD in July. This meeting, Governor Janklow's Capital City Conclave on Distance Education, brought a dozen national and international experts in distance education to South Dakota to interact with state leaders. Also, there seems to be a level of leadership being provided by staff (change agents) from the Department of Education and Cultural Affairs (DECA) that was not apparent when this evaluation began. This leadership seems to transcend the *CTS Project*. While leadership is difficult to document, many comments from South Dakota educators summarized in this report refer to the positive influence of DECA staff.

It is obvious that the *CTS – Phase III* project's activities have been accountable, and that early indications are that they have been effective in meeting stated objectives. The impact of the project's initial activities will be determined over time. Baseline information has been collected and will permit a clearer determination of impact in subsequent reports and in future years.

It is clear from information collected that the organizational context in which distance education exists in South Dakota is evolving, as it should, and that additional changes will need to be considered. Finally, it seems that a number of new and potentially important activities are being considered that were not anticipated when the *CTS Project* was planned. This is to be expected and is considered by most evaluators as an indication of effectiveness.

Significant suggestions identified as a result of evaluation of the diffusion of distance education in South Dakota include the following:

- Many of the participants of the six special workshops held during the spring and summer of 2000 were selected because they were considered to be opinion leaders. The data support that many opinion leaders did attend these workshops.
- A large number of the participants of the Distance Teaching and Learning (DTL) and Technology for Teaching and Learning (TTL) Academies had relatively low levels of personal innovativeness.
- Classroom teachers are the group most emulated by workshop attendees, TTL/DTL attendees and South Dakota teachers, in general. Classroom teachers are a group that increasingly should be used as opinion leaders. This will speed the diffusion of distance education in South Dakota.
- The process of using change agents to orient opinion leaders who in turn work with teachers and other adopters is a good one that seems to be working effectively in the state.
- Trialability and observability have been recognized as critical to the adoption of distance education in South Dakota. Trialability and observability opportunities should be increased in number and location to speed the adoption of distance education.
- An increased number of TTL/DTL attendees are likely to have relatively low levels of personal innovativeness indicating a reluctance to adopt distance education. A different strategy for providing staff development to these educators should be considered. Specifically, individuals with strong reluctance to adopt an innovation can not be easily influenced by normal diffusion strategies (Rogers, 1995). Rather, most efforts should be directed at educators with higher levels of innovativeness towards distance education. This is not to suggest that those with low levels of innovativeness should be ignored. Instead, efforts should be focused on other, more innovative educators.
- According to the data collected, younger, highly educated South Dakota teachers are a group that should be used to provide leadership for the adoption of distance education in the state.
- Continued support of teachers who adopt or are considering the adoption of distance education after the DTL Academy experience should be available. Mini-grants, short workshops, visits by Department of Education and Cultural Affairs staff, and publicity for projects are examples of ways to provide continued support for educators who are using the DDN and distance education.

In summary, the strategy developed to diffuse distance education into the educational community of South Dakota appears to be an approach to be modeled by other states and regions that are interested in developing a large distance education system.

First, change agents working for the Department of Education and Cultural Affairs were used to provide training and support for educators emulated by their peers. These groups received special attention in workshops designed expressly for them. These educators were considered to be opinion leaders; individuals looked to by their peers as persons to respect. Next, a large number of educators were given in-depth staff development in lengthy Distance Teaching and Learning Academies. Finally, the trained educators returned to their local schools and communities where they were supported by staff from the state department of education in efforts to use the Digital Dakota Network for distance education. The process of diffusion of the innovation of distance education was research and theory based (Rogers, 1995), evaluated systematically (AEIOU Approach), and dynamic so changes could be quickly implemented to respond to unanticipated events. In South Dakota, Daniel Burnham's famous statement is the watchword.

"Make no little plans; they have no magic to stir the blood!"

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Student-governed electronic portfolios as a tool to involve university teachers in competency-oriented curriculum development

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Abstract

At the University of Twente a new curriculum on educational science and technology has been introduced. That occasion was used to try to develop an apprenticeship model in which the students are regarded as young professionals from the very beginning. In that model the students are expected to govern their professional growth by actively collecting evidence of acquired competencies in electronic portfolios. This activity should stimulate teachers to adapt their teaching style to the requests from students for feedback on products that the students would like to put into their portfolios. After three iterations of development in three consecutive academic years, however, the use of portfolios is still not successful. The reasons why are discussed and steps to be taken are suggested.

The Project

The Faculty of Educational Science and Technology at the University of Twente in the Netherlands is educating educational designers with specializations in seven directions: curriculum development, instructional technology, instrumentation (media, computers, and internet in education), educational organization and management, Human Resources Development (HRD), educational testing, and social science research. The Faculty intends to switch to a competency-oriented curriculum for its three-year Bachelor program.

The term 'competency' is partly to be understood in terms of the knowledge and skills that comprise the competency profile of a profession and partly as the ability "…to operate in ill-defined and ever-changing environments, to deal with non-routine and abstract work processes, to handle decisions and responsibilities, to work in groups, to understand dynamic systems, and to operate within expanding geographical and time horizons" (Keen, 1992). Knowledge and skills can be assessed in traditional ways. The kind of behavior as described by Keen is more difficult to observe. This at the same time causes a problem in terms of the extent to which competency in Keen's terms should dominate the whole philosophy and organization of the program. To get around this problem, competency development was seen as an activity that can take place in concert with doing traditional coursework, as long as the students would be able to handle the related learning experiences from a meta-cognitive level that complies with Keen's definition of competent behavior.

The use of portfolios offers a possibility to build evidence of the development of competencies. The main attraction of portfolios is formed by its potential to assess progress and process as essentials for learning (Saywer, 1994). In the new curriculum portfolios are introduced for self-assessment by the students as well as for monitoring their progress.

Starting in the academic year 1999, electronic portfolios were introduced to provide students with a tool for actively working on competency development. The introduction was monitored and the use of the portfolios was developed in a few steps aiming at answering the following question:

> "Do student portfolios yield sufficient support to help students to direct their own development in a competency-oriented curriculum, and if so, under what conditions?"

The literature shows growing consensus that educational reform efforts are doomed to fail unless the teachers' cognitions, including their beliefs, intentions, and attitudes, are taken into account (Haney, Czerniak, & Lumpe, 1996). The introduction of student portfolios is not only planned to serve the purpose of the students, but also as a tool for the implementation of the new curriculum. The latter relates to the readiness and willingness of teachers to adopt a new approach, for which the following question should be answered:

> "Does student-directed collection of evidence of professional growth influence teaching style of academic staff?"

The educational concept "initiation in the academic profession"

The new curriculum approach is based on a concept that is labeled: "initiation in the academic profession" (Verhagen, 2000). It is an apprenticeship model in which the students who enter the university directly from secondary school are regarded as young colleagues from the very beginning. A central principle of the concept is that the interaction between students and teachers should take place in a professional context as much as possible in stead of interaction in an instructional context. Assignments should as much as possible mirror professional practice to help students to develop professional behavior. The result of a literature assignment should take the form of the literature part of a scientific article; communication products of design assignments such as proposals, budget estimates, blueprints or evaluation reports should take a form that would be appropriate to present to clients; and so forth. Teachers should primarily be regarded as experts who enable the development of academic insights by scientific discourse.

To make this work, a new approach of mentorship has been introduced together with the new curriculum. Each student becomes a member of a mentor group that is chaired by a staff member of the faculty. A mentor group consists of about 12 students from all three years of the Bachelor program, about four students from each generation. The mentor groups provide a social structure in which the master (the mentor/staff member) and the experienced students from the second and third year help the first year students (the learners) to be initiated in the professional culture of academic professionals. In these groups the discussion of personal development towards becoming a competent professional is a standing issue. The group members are required to collect evidence of professional growth that lends itself for discussion with the mentor and in the mentor groups.

The students collect the evidence of their professional development in their electronic portfolios. Each portfolio consists of four parts: (a) An introduction of the owner (student), (b) a text based curriculum vitae, where the student is expected to put personal information, information about his or her school career, information concerning professional development in or outside of the official program (like having a job in the field) and other information such as involvement in sports and hobbies; (c) an archive, where the student puts evidence of his or her professional development during the study; and (d) a showcase where the student chooses to present a selection of his or her best work. The archive is the central tool for the student to perform self-assessments about specific accomplishments as well as to reflect on personal development in general. Self assessment is considered to be a form of metacognition that is essential for self-regulation (Simon & Forgette-Giroux, 2000).

Additional features of the new curriculum are that the development of information and communication skills is integrated into courses and that all courses are organized using a Web-based course management system (TeleTOP, a home-made Lotus Domino application).

The implementation of the new approach requires a substantial change of teacher behavior. Most teachers are used to teacher-controlled instructional formats. Some teachers, however, share the philosophy of the new curriculum concept. They should act as the pioneers and early adopters who provide a critical mass of authentic professional tasks that allow student to develop the necessary skills for self-regulation of their academic education. These tasks and the interaction in the mentor groups are expected to shape the attitude and abilities of the student into characteristics of self-reliant young professionals. The extent to which this will appear to be true will answer the first research question.

Approaching the students in such a way that they perceive the need to adopt a professional attitude is expected to cause students to work conscientiously on compiling evidence of their professional development in the form of portfolio products. They then will seek feedback of the teachers on their work and ask for comments on the added value of assignments for the objectives of a course and in the framework of the competency profile of the Bachelor program as a whole. It is expected that this behavior will influence the teaching style of the academic staff and will help teachers who are reluctant to invest in the new educational concept to move in the desired direction. The extent to which this effect occurs, will answer the second research question.

The first experiences

Preparing for the academic year 1999-2000

The principles of the new approach have been presented to the teaching staff on several occasions, at first to estimate whether the concept was appealing to them. The overall impression was sufficiently positive to start the preparation of the introduction of the new approach in the program. A few months before the academic year 1999-2000, a group of student-friendly staff members was invited as mentors. Together with the faculty management they developed procedures and a related manual to start the new mentor groups. Involving the mentors at this stage resulted in their ownership of the concept for the new mentor groups and the way of working in those groups. Elements of the approach are that competency development was related to three major roles of professionals in our field: designer, researcher, and consultant; and that explicit attention should be paid to generic competencies such as planning, self management, interpersonal skills, communication, and academic reflection. In respect to the individual development of the students, a list of products that should be collected in the portfolios was specified. They concern results from assignments in courses that may be considered as evidence of acquired knowledge and skills, thus contributing to the competency profile of the student. Monthly professional meetings of the mentor groups were planned to discuss progress. During these meetings also attention was paid to the quality of the program as experienced by the students. It was expected that the students in their role as beginning educational designer should be interested in strengths and weaknesses of the courses in which they participate. The input from the mentor groups was also considered as valuable for the formal evaluation of running courses. The teaching staff was informed about the intended approach and invited to work accordingly.

Outside the mentor groups, information and communication specialists developed their curricula in close cooperation with teachers from selected courses to arrive at the integration of relevant tasks and assignments in the different courses.

Results from the academic year 1999-2000

The mentor groups appeared to be handicapped by the fact that it was the first year and thus only first-year students were members. The monthly meetings failed also because the students had such a close contact with each other throughout the week, that no substance to discuss remained for the meetings. Course evaluations became a formal ritual with no real impact.

Teachers and students appeared to behave more traditional than expected, leading to much interaction in an instructional context and little in a professional context. The instructivistic teaching style in many courses appeared a dominant factor in shaping student behavior. In stead of working on a professional attitude that complies with the model of the students as young colleagues, the students felt that they went to school to take lessons and make tests.

Moreover, due to technical problems portfolio software was introduced to the students at a late stage (the end of the first semester). Students had then to go back to already completed courses to find the required products for their portfolios. It was unlucky that for unclear reasons they appeared not to be informed about the list of required products that existed from the beginning of the academic year. And when they learned about the list, several students became annoyed because they consider that list as contradictory to the concept. If the portfolios are tools for governing one's own learning process, they should be able to decide by themselves what to put into it. At that time, so much was unclear, that most students failed to work with the portfolios in a proper way. In conclusion, the electronic portfolios were hardly used.

The only thing that really worked was the integration of information and communication skills into courses. The carefully developed set of tasks on information and communication skills made the students acquire the related skills every time they needed them for the assignments in the courses. A literature assignment in a course on pedagogy was used to teach them how to find literature, an assignment to write a paper for an other course was used to explicitly pay attention to writing skills, and so on.

2000-2001: Some changes

The insight was developed that students should not be forced to put products in a portfolio, because this is contradictory to self management. The students, who were interested in the desired approach, told that to us more than once and they were right at this point. The mentors were asked to guide the students in developing self-management skills, using the electronic portfolio as a discussion platform.

Now that students of two study years were member of the mentor groups, activities were specified that could bring the concept to life. The elderly students could now introduce the new students to all kinds of procedures and habits in the faculty. And group discussion could now aim at points of interest for which the vision of both the first year and the second-year students was relevant. The number of official meetings, however, was reduced to seven. This measure was taken to avoid the problem of too few subjects for discussion that came with the monthly meetings in the first year.

Changing the teaching style of teachers towards competence development seemed not to be possible directly. So a major role for the mentor was envisioned given the character of the guild model in the mentor groups. The mentors were asked to work with the students on helping them to use their portfolios for self-governance.

Results from the academic year 2000-2001

This time the mentors started to resist to the idea that they should work with the students in such a way that the students would develop the met cognitive skills to monitor their own professional growth with the electronic portfolios as the basic tool. They argued that the curriculum and the way in which the courses are taught, should have this effect.

Again, the portfolios were hardly used although the software was now available almost from the beginning. But the early start had also a disadvantage. The students were introduced to the portfolio software in a workshop where to technical skills were practiced without real products to put into the portfolio. The first products that would be suitable had still to be produced in the courses that just were started. By the time that the portfolios could be used, most students had forgotten how to do that. As there was this time no list of required products, only few students appeared to motivate to start filling their portfolios. Many other students, however, appeared not to be able to decide what they could put into the portfolio. Partly the reason is that they appeared to be very critical of their first-year products, considering their own work as real beginner's work that is not worth to be put into a portfolio.

The cooperation between students from different years appeared to be one-sided. Only in the beginning of the academic year were the older students active when introducing the new students. Subjects of mutual interest to old and new students were not identified. The new students could also not bring anything of relevance for the older student. The question: "What are my benefits?" was hard to answer for the older students.

Still, the students were positive about the meetings of the mentor groups. During the meetings the students discussed general information with their mentor and with each other and they used the meetings as a platform to complain about organizational or educational problems in the faculty. They could speak freely about anything, which gave the meetings an "I am not alone with this" function.

Putting students in control

2001-2002: A last chance for portfolios?

Gradually it becomes clear that the basic philosophy of the concept "Initiation in the Academic Profession" does not really settle in the faculty. They believe that the concept is worthwhile, is reason for a third attempt. This is where the approach was developed that is the reason for this paper. Again the idea is that the students should develop initiative in using their portfolios as a tool for collecting evidence of their professional growth. In the first week of the academic year, they were trained to use their portfolios in two ways: technically to learn how to put elements in the portfolio and how the manage the portfolio; and conceptually on how to use the portfolio for monitoring and managing professional progress. An adapted guide for the mentor groups explained the purpose and the philosophy: It was recognized that not all students are ready for this kind of metacognitive activity. They are therefore allowed to use or not use their portfolios for self management. Filling the archive with products of courses, however, is this time required to maintain basic portfolio skills until the moment that the student is ready and willing for the intended use.

The results so far

The number of students that works with the portfolios in the intended way is neglectible. There are just a few students who work with their portfolios. These students are mostly using the archive function just for their own purposes and not to reflect on what they have done in past periods. Also most mentors still don't use the portfolios for the individual meetings with the student. Some of them do, but they leave no room for self-directedness by the students because they *require* the students to fill the archive.

In the meantime, the discussion about the usefulness of portfolios has become an issue in a broader perspective. Students who are following the old curriculum (from before the introduction of the new educational concept) start asking for their own portfolios for making overviews of products that they collect in courses during their study. So these oldest students see the purpose and the advantages of portfolios from a need for systematically archiving products. Regrettably, however, when providing them with the portfolio software, they don't find the time to really do it. It seems a similar phenomenon as with the staff members who like the idea of the new educational concept, but do not really change their methods to comply with it.

When student and staff members are asked what they think about the portfolio idea, they are almost all very positive. But still, it did not work out. The project fails and we have to find out what we may learn from it.

Discussion

Why portfolios can be a success

When looking for a field where portfolios do work, the field of Human Recourse Development (HRD) is an obvious one. Self-responsible adults, who have a job and related responsibilities, benefit from individual learning arrangements that are reported by collecting evidence of achievements in a portfolio. The use of (electronic) portfolios is in that context appropriate because the learner has sufficient metacognitive (and computer) skills to use the portfolio tool properly. An educating agency (training department, external course provider, etc.) shares the philosophy of competency-based education and is therefore open to assessment on the basis of individual portfolios. This context is essentially different from the university situation where young students who enter the university directly from secondary school, do not have the maturity, the experience and the interest to work along these lines. This is the starting point for discussing why portfolios may fail.

Why portfolios fail

Portfolios fail when the students don't see the value. Portfolio proponents tend to deny the psychological developmental stage of the students. But many (young) students are not prepared or willing to look at themselves in the metacognitive way that is required for proper dealing with portfolios. Further it seems that the spontaneous fun in studying theory is hampered by precise questions about the requirements that have to be fulfilled for a competency-based curriculum. A student who is really involved in a subject, has to make a severe mental switch when he or she has to step outside that subject to analyze on a metacognitive level whether what he or she is doing is a contribution to the development of competence.

And even when students see some value, for instance for building a comprehensive archive of their work during their study, they may misinterpret the function of the archive by denying products of which they are not very proud, like the first-year products when they feel themselves still beginners. To reflect on professional growth, however, these products are needed for reasons of comparison with later accomplishments. Proper guidance of the students by mentors could help, but this requires that the mentors are convinced of the value of portfolios as a tool for monitoring progress. In our case, we were clearly not able to motivate the mentors in this sense.

And there is also a very practical reason why portfolios may fail. That is when the software causes problems. The system may need too many steps for simple tasks; the server may too often be too busy, and so on. In our case, several technical limitations did for certain not stimulate the use of the portfolios.

Portfolios also fail when the teachers fail to adjust their teaching accordingly. Teachers are mainly prepared to carry out a well-defined course. When they have to step beyond the concrete patterns to adjust themselves to individual trajectories, many teachers fail to comply with that fact. The idea that a concept such as "initiation in the academic profession" can be put into practice outside the courses by regarding the traditional courses as occasions for gathering portfolio products that are used by the students and mentors, does not work. The concept and the use of the portfolios have to be operationalized within the courses.

Where to go from here?

Who wants to succeed in an effective learning process, ought to be able to coordinate his own learning process (McCombs, 1988). In order to make the concept "initiation in the academic profession" successful, we will have to arrange a situation in which the students will be helped to get ready to do so. And this has primarily to happen in courses, while the new mentor groups may have a support function. The developmental readiness of the students has to be taken into account. Alexander (1995), for example, mentions three stages for the evolution for the learner. In the habituated stage, the student has a diminutive knowledge level. Having just a little domain-specific knowledge the student appeals on common strategies. The second stage is the ability or competency level. The students get more comprehensive and coherent knowledge of the subject and there is a change the student will select the correct strategy for the specific situation. The third stage is the expert level. At this stage the students have ample knowledge of domain specifics, are ready to regulated themselves, and are able to add new knowledge to the domain. These stages ask for a curriculum line in which each stage has a logical place. This leads in our case to a choice for courses in which the three stages have a natural place: the series of courses about design methodology that runs form the first to the third year. This choice is inspired by the Design Studio as it works at the Master's level at the University of Georgia at Athens (Rieber, 2001). The principle as it will be tried in our program is that third-year students will take responsibility for design assignments while second-year students will act as helpers for specific tasks that need already proper workmanship (like carrying out a literature study or an evaluation), and first year students will be used for very concrete tasks for which it is not necessary to be very knowledgeable about the specific domain. In this stream, the principles of the concept "initiation in the academic profession" may be fully exploited, together with the use of portfolios. Next to and in balance with this stream, theory courses may still be taught in more traditional ways as long as all teaching complies with the seven principles for good practice in undergraduate education as listed by Chickering en Gamson (1987, quoted by Chickering en Ehermann, http://www.aahe.org/technology/ehrmann.htm): (a) good practice encourages contacts between students and faculty, (b) good practice develops reciprocity and cooperation among students, (c) good practice uses active learning techniques, (d) good practice gives prompt feedback, (e) good practice emphasizes time on task, (f) good practice communicates high expectations, and (g) good practice respects diverse talents and ways of learning.

After the lessons learned with our attempts to introduce electronic portfolios faculty wide, we hope that the more modest approach for introducing portfolios and competency-based learning in the design stream of our program, will appear to be the right step to help to initiate our students into the academic profession.

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The Development of a Model for Using E-Portfolios in Instructional Technology Programs

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ABSTRACT

E-portfolios have an ease of use that former paper-based portfolios do not. Virginia Polytechnic Institute and State University uses eportfolios as a method to assess students in the Instructional Technology graduate program. A core of volunteer graduate students assumed the responsibility of designing a model for using e-portfolios based on the new AECT standards. This paper explores the process and decisions involved in developing a specification for an easy-to-use e-portfolio system to assess, evaluate and display graduate students' work. Issues discussed include the nature of the students' role in the development of the model and their subsequent recommendations for preserving a well-defined structure for the e-portfolio to meet the needs of the faculty without sacrificing the ability of the students to be creative with the display of the content. Implemented items from this investigation included a template-based system with a checklist of required components for the e-portfolio. Included in the recommendations is a data-driven approach that separates the content from the structure of the e-portfolio, making it possible to easily enter the information and re-purpose it for a variety of formats and uses.

Background

The professional development portfolio was conceptualized for use by the Instructional Technology (IT) Program at Virginia Tech in 1993 as a means for faculty in the department to assess student work at different stages of matriculation. The portfolio was also a way for the program to gauge its current practices of teaching and learning. For students, the portfolio served as an excellent tool to archive and showcase their work. The early portfolios were displayed in non-electronic form. Students would present the work they completed in class during program-wide examinations (qualifying exam, preliminary exam, final defense). As technologies advanced, the requirement was modified to give students the option of creating an electronic portfolio. This was again modified later to make an electronic portfolio mandatory. The faculty also adopted the original AECT standards that consisted of seven primary competency areas. Although all of the portfolios had the same seven topical headings, the design for these portfolios was left to the discretion of each individual student.

When the new AECT standards came out in 2000, the faculty adopted them for use with the electronic portfolios. The electronic portfolio, however, continued to have several shortcomings. The lack of guidelines led to a great deal of variation in interpreting the AECT standards and in formatting the portfolios. In addition, students had many questions about how to develop their portfolios and faculty members had a difficult time comparing the portfolios across students. As a result, the Professional Development Portfolio (PDP) committee was formed to attempt to incorporate the new AECT standards into the departmental PDP and to find solutions for these problems.

Beginning of PDP Committee

The Professional Seminar committee, which plans seminars for IT graduate students, developed a seminar on the professional development portfolio anticipating the changes in the AECT standards. During this seminar, the new AECT standards were presented and a number of students who had already created electronic portfolios volunteered to show their work to new students in the program who were going to develop portfolios in the near future. Based on the comments from both students and faculty during this seminar, it became obvious that the portfolios were very different from student to student, which made it difficult for faculty to compare the PDPs. As a result, a student-led committee, which included a faculty advisor, was created to propose a more systematic PDP model for use by future students. Although it still had to be approved by the faculty, this "bottom-up" approach allowed students to have a voice in making changes to enhance the program.

The PDP Committee subsequently went to work on researching electronic portfolios. Researching the use of portfolios, both electronic and non-electronic, was undertaken through three methods: reviewing literature, evaluating other IT programs, and interviewing IT faculty and students.

Literature Review

In reviewing the literature, the committee investigated portfolios and their definitions, their uses and advantages, and their development. The committee also followed this initial review with an investigation of the AECT standards and their suitability as the assessment measure for the professional development portfolio.

Much of the literature found on the topic of portfolios was in support of their use in education. Portfolios are defined as selective and purposeful collections of student work made available in either electronic or non-electronic formats (Adams & Hamm, 1992). Portfolios provide meaningful documentation of an individual's abilities and represent a "learning history" over a period of time (Meisels, 1994). The use of portfolios in education leads to learning environments that are more student-centered because students accept more responsibility and become the agents of their own education (Paris, 1992)

Barrett (2000) explores the steps necessary for creating portfolios. These steps include deciding on an area of assessment, selecting assessment measures, collecting and selecting content, reflecting on and organizing the content, and presenting the content. The committee decided to adopt this process as a method to guide the subsequent development of the PDP model.

In the investigation of the suitability of using the AECT standards as the assessment measure for the portfolios, a primary question arose: why did the department of Instructional Technology at Virginia Tech choose to use the competencies and what have they to gain from including them in the professional development portfolio? The faculty at Virginia Tech chose to use the AECT competencies because of the reputation AECT has in the instructional technology field and its leadership in promoting professionalism in the field through the National Council for Accreditation of Teacher Education (NCATE). In addition, the IT faculty at Virginia Tech felt that they gained a measure of professional accountability through the use of established standards.

Further investigation of the AECT Standards addressed several areas. These areas included a developmental history of the AECT standards, the theory behind the standards, and the standards themselves. AECT standards came into existence in the 1970s when then president Robert Heinich appointed task forces to look into accreditation and certification issues addressing "concerns for the place of instructional technology in teacher education and for the professional preparation of media personnel" (Association of Educational Communications and Technology, 2000). As the years passed, standards, or guidelines as they were then called, were approved and revised. Finally in 1996, NCATE requested a change to performance-based accreditation, thus requiring AECT to make revisions to the standards once again. AECT revised their 1994 standards to reflect NCATE's request. In order to do so, AECT used the major domains of the field as defined by *Instructional Technology: The Definitions and Domains of the Field*, written by Seels and Richey in 1994 (see Figure 1). The new standards, which were used for this project, were approved by both AECT and NCATE in 2000 (Association of Educational Communications and Technology, 2000).

The AECT standards were based primarily on the theoretical framework contained in the work found in two books: *Instructional Technology: The Definition and Domains of the Field* (Seels & Richey, 1994) and *The Knowledge Base of Instructional Technology: A Critical Examination* (Richey, Caffarella, Ely, Molenda, Seels, & Simmonson, 1993). The first book offers a definition of the field, or assessment area for the portfolio, and a description of the domains and sub-domains of the field. The second book provides the theoretical underpinnings of each domain. Seels & Richey's definition of "instructional technology" is as follows:

> Instructional Technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources form learning... The words Instructional Technology in the definition and a discipline devoted to techniques or ways to make learning more efficient based on theory but theory in its broadest sense, not just scientific theory... Theory consists of concepts, constructs, principles, and propositions that serve as the body of knowledge. Practice is the application of that knowledge to solve problems. Practice can also contribute to the knowledge base through information gained from experience... Of design, development, utilization, management, and evaluation refer to both areas of the knowledge base and to functions performed by professionals in the field... Processes are a series of operations or activities directed towards a particular result... Resources are sources of support for learning, including support systems and instructional materials and environments... The purpose of instructional technology is to affect and effect learning (Seels & Richey, 1994, pp. 1-9).

Figure 1 illustrates how the field's theoretical underpinnings are divided into five domains (Seels & Richey, 1994). The related sub-domains are listed under each domain.

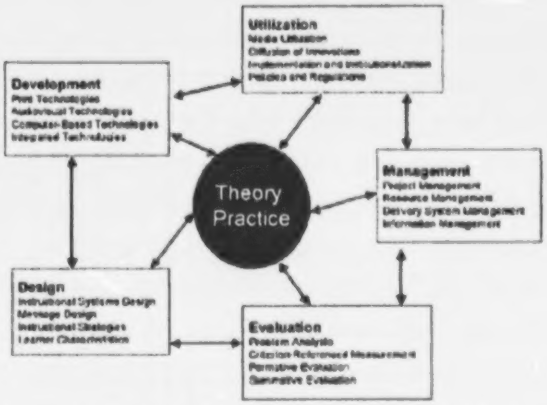
Utilization
Media Utilization
Diffusion of Innovations
Implementation and Institutionalization
Policies and Regulations
Development
Print Technologies
Audiovisual Technologies
Computer-Based Technologies
Integrated Technologies
Theory
Practice
Management
Project Management
Resource Management
Delivery System Management
Information Management
Design
Instructional Systems Design
Message Design
Instructional Strategies
Learner Characteristics
Evaluation
Problem Analysis
Criterion-Referenced Measurement
Formative Evaluation
Summative Evaluation

Figure 1. Domains of the Instructional Technology field. (Seels & Richey, 1994)

In terms of the standards themselves, there are two categories: the initial programs in Educational Communications and Instructional Technology (ECIT) and the advanced programs in Educational Communications and Instructional Technology. The initial ECIT programs are the basic entry into the field and are typically masters level programs that lead to certification. The advanced ECIT programs focus on knowledge and skills that go beyond the initial program. There are five domains in each program: development, utilization, design, management, and evaluation. The definitions of the domains are as follows:

> Design refers to the process of specifying conditions for learning. Development refers to the process of translating the design specifications into physical form… Utilization refers to the use of processes and resources for learning… Management refers to processes for controlling instructional technology… Evaluation is the process for determining the adequacy of instruction. (Seels & Richey, 1994, pp. 24-43).

The standards are the same for both programs; it is in the implementation or performance of the standards that the programs differ. The difference between the two is of quantity and depth. The advanced program requires more activities and higher quality performance than the initial program.

Once the literature review was complete, The PDP committee was convinced of the usefulness of portfolios in education. In addition, the committee agreed that the AECT standards justified their use with a well-defined area of assessment (the instructional technology field), a solid theoretical base and a stringent review and accreditation process. The committee recommended the use of the initial ECIT standards as the framework for the master's level Instructional Technology students' portfolios and the advanced ECIT standards as the framework for the doctoral students' portfolios at Virginia Tech.

Other IT Programs

In order to complement the literature review, the committee attempted to evaluate the use of electronic portfolios by reviewing websites of eight well known IT programs. However, the use of portfolios was not well documented on the web, so the committee contacted representatives of each program directly. Members of the committee e-mailed a contact person from each of the IT programs requesting information about their use of portfolios. The results from evaluating other programs did not provide any consistent approach. Other programs indicated that they: 1.) did not use portfolios; 2.) had an optional portfolio; 3.) had an analog/electronic portfolio option; 4.) created their own standards; and 5.) used AECT or other organizational standards. These findings only served to substantiate the committee's purpose and commitment to developing a more consistent set of PDP standards.

Faculty/Student Interviews

Interviewing several members of the IT program's faculty provided valuable insight as to the rationale behind the use of portfolios and their needs in regards to the portfolios. Interviews with students in the program also provide information about their needs as well. Although the interviews were done in an informal manner, the anecdotal information the faculty and students provided helped the committee to develop guidelines for use with the portfolios. Much of the information gathered from those interviews was used in the writing of this document and in the subsequent implementations and recommendations that came from this investigation.

Needs Analysis

Once a framework was adopted for the electronic professional development portfolio model, the committee began to investigate the specific needs of the primary stakeholders, the faculty and the students. The primary goal of the team working on the model was to identify these needs and to propose a portfolio solution that would accommodate each set of needs as effectively as possible.

Many of the faculty noted the growth they witnessed from the time they first saw a student's portfolio at the qualifying stage to the final defense. Students also recognized their own growth throughout the process and felt as if they had a way to show their work. Moreover, students discussed how employers often appreciated their level of preparedness. Nevertheless, although both the faculty and students had good things to say about the use of portfolios in the IT program, it soon became obvious that the portfolios, as they existed, did not completely meet their needs.

Faculty Needs

The faculty analysis resulted in three specific areas in which needs were expressed with regard to the PDP. These areas include: 1.) Assessment, 2) Accessibility, and 3.) Ease of Use.

Assessment

For the faculty, the primary area of importance in terms of the PDP is the ability to assess the work that students placed in the portfolio. Faculty members decided that a portfolio based on the AECT standards would be a useful method for assessing the overall achievements of students in the program both on their own merits and in comparison to other students. The faculty put forth general requirements for items to include in the portfolio for assessment, consisting of courses taken, activities performed, and products produced. However, as the PDP currently exists, the faculty has not provided specific requirements as to the manner in which the material is to be presented. This was done, in part, to provide the students with freedom to be creative with the design of their PDPs. In many respects, the PDP became, from the student's perspective, the culminating design project of the degree program. The lack of a defined structure, however, has made it difficult for the faculty to be able look at the portfolios and assess the quantity and quality of work from one student to another.

The ability to easily assess the quality of a student's work in comparison to other students using the PDP necessitates that the portfolios be as consistent as possible. This consistency can be achieved through both content and format guidelines. Presently, however, such guidelines have not been created due to the differing nature of student and faculty needs with regard to the PDP. To establish stringent guidelines with regard to content and format may hinder student creativity and also their ability to customize the PDP for specific job searches. Taking some of the control of the development of the PDP away from the students may force them to double their work by creating two portfolios – one for the instructional technology faculty and one for prospective employers.

Accessibility

The faculty also indicated that the portfolios provided by the students needed to be easily accessible. When the portfolios were integrated into the instructional technology department, they were primarily paper-based. Eventually, they were moved to their current electronic form in order to make them easily accessible to the faculty. However, current lack of specific electronic guidelines with regard to how the PDPs are packaged does not ensure easy access from one computer to another or one application to another, such as a browser.

Ease of Use

Finally, the faculty indicated that it would be desirable if the material in the student PDPs could be easily used for data purposes. An example included the ability to track classes, experiences and projects through a database. In such an environment, theses variables can be related and compared across students over periods of time.

Student Needs

The student analysis resulted in four specific areas in which needs were expressed with regard to the PDP. These areas include: 1.) Clear definition of requirements, 2.) Flexibility for creativity, 3.) Usability for both academic and job related activities and 4.) Easy modification of content.

Defined requirements

Students used the PDP primarily as a means to fulfill the requirement set out in the series of oral departmental exams. The main requirement set forth by the faculty was that the PDP be web-based and that all classes, projects and professional experiences be represented. The required structure of the document was only that these items be represented so that it was apparent how each related to the original seven competencies detailed by AECT. This limited set of requirements allowed for a great deal of variety in the design of PDPs and promoted confusion among the students as to what was required. Students' inaccurate understanding of the PDP made it clear that it would be helpful to make the requirements more comprehensive. In addition, well-defined structural requirements would reduce the amount of time spent by the students in development of their own PDP. This is especially the case for students who are not as experienced in web or graphic design.

Flexibility to be creative

The original setup allowed for a great deal of personal freedom in structure and displays. Although the PDPs had a similar outline-based structure that consisted of an introduction with a definition of the PDP followed by seven sets of lists, the overall design was unique from student to student. Flexibility was exercised in visual aspects of the site such as images and color scheme. The students wanted guidelines, but also desired the flexibility to design the "look and feel" of their portfolios.

Usability for both academic and job related activities

It was important for students to have a PDP that would also work as a non-academic portfolio. Often the structure used to meet the needs of the IT faculty at Virginia Tech was not appropriate for prospective employers. As a result, students often had to re-design their portfolios for use in job searches. Since the content and format were tied together in the electronic portfolios, this required much time and effort.

Easily modifiable

The PDP is continuously modified throughout its development. A well-designed PDP should allow for easy addition of content, as well as resorting of items already included, without the need to recreate the document format or navigation systems.

Solutions

The recommendations of the group came in three forms. The first piece was a prototype PDP to be used as a model for future PDPs. A "how-to" manual was developed for students to guide them through creating their own PDPs. The last piece consisted of a set of recommendations for future investigation.

Prototype

The prototype was a website developed from content in an already existing PDP. A template-based system was recommended in order to provide clearer guidelines for the students as they develop their PDPs. Though this recommendation removes the students' flexibility in the aesthetic aspects of their PDP, a more standardized model had the benefit of reducing ambiguity in the development of the PDP. The imposition of these content and format guidelines also meets the need of the faculty to easily locate, analyze, and compare the work of students across PDPs. Through the use of the template, the content is more consistent, comparable, and thus, more assessable.

In the prototype, each page on the site contains a side bar navigation system that allows the viewer to link to any of the other major sections within the site. As shown in Figure 2, the site contained 5 major sections: (1) Entry page, (2) Vita, (3) Checklist, (4) Competency listing, and (5) Referenced items.

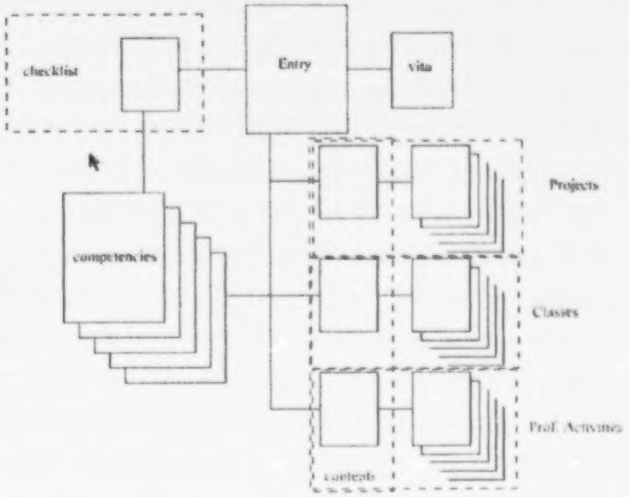

Figure 2. PDP Site Map

The entry page was set up as an introduction to the individual student's PDP. A personal statement is the most prominent content of the page. The student has the ability to add links to outside personal information from the entry page. (Faculty felt that sensitive personal information should be removed from the entry page, as the PDP site is not secure.)

Faculty and students both felt that a vita should be included as a part of the PDP as it is considered to be a standard element in the professional development of an Instructional Technology student. Since there are already established guidelines for vitas, the prototype simply focused on a location in the site to place the vita, not on how to develop one.

The checklist identifies all of the required components in each of the major areas of the PDP in a table (see Figure 3). The checklist allows the students to identify which components have been included in the PDP by inserting a checkmark graphic into the appropriate cell of the table. This chart is sorted by competency and type of referenced item (classes, professional activities, projects). This method allows the faculty to quickly judge the breadth of the student's experiences as defined in the portfolio. In addition, it provides the students with a clear set of guidelines indicating what is required in the portfolio.

Figure 3. PDP Checklist

Classes	Professional Activities	Projects	Competency Area
			Design
✓	✓	✓	· Instructional Systems Design
✓	✓	✓	· Message Design
✓	✓	✓	· Instructional Strategies
✓	✓	✓	· Learner Characteristics

The competency section of the site details each of the 5 categories of the AECT standards. Like the checklist, this section is included to assist the students in defining their experiences as they relate to the profession. General as well as itemized definitions as put forth by AECT for each competency are listed on the pages. At the end of each page, there are links to classes, projects, and professional activities that relate to that competency.

In addition to linking to the referenced items through the competency pages, the PDP contains three pages that list out all items by category. The categories for the referenced items are classes, projects, and professional activities. This will allow the viewer to isolate types of work (e.g., class projects, and professional activities) across the competencies. This also allows for alternate groupings and classifications to be set up if needed. Creating a new table of contents, and linking the appropriate items to the contents page, will allow for a completely new structure for a portfolio for viewers other than the IT faculty. If the student wishes to modify the appearance of the page, only the templates for the sections need to be modified and the whole site will reflect the changes.

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"How-to" document

The "how-to" document was created as a guide for students to creating their own PDPs. It contains explanations of competencies, descriptions of the required elements, and recommendations for development and maintenance of the PDP. The competencies describe in detail the AECT areas that the students are expected to use as a framework for populating the content in the PDP. This section also describes how the Instructional Technology department will work with students if they wish to emphasize specific components of these competencies. The description of required elements outlines what the faculty expects from the students in terms of competencies and other activities. These other activities include the development of a vita, consulting, teaching, researching, and mentoring newcomers to the profession. The development and maintenance section includes recommendations for setting up a website to house the PDP and techniques for modifying and updating the content in the PDP. This document provides clear guidelines and developmental procedures for students. In addition, by clearly laying out these guidelines, the faculty has a reference point with which to evaluate the portfolios.

Future Recommendations

In the discussion of how to develop a PDP, the group made recommendations for future exploration of several concepts. The committee began to explore standard formatting structures for the PDP, such as HTML or XML and the use of cascading style sheets for formatting. These structures could ensure consistency of PDPs across computer platforms and browsers. The committee also investigated the possibility of the PDP structure existing in a database-driven environment that separates the content of the PDP from the recommended template. By having all of the content entered into the database and then automatically populated into the template, the faculty would be able to isolate and/or compare specific pieces of content within a database system. This would facilitate management and organization of large amounts of data from the PDPs from a variety of students across many years. In such a system, students adding content would not need to worry about formatting. The recommended template would automatically be populated with the content maintained in the database. In order to take into account the needs of different students, multiple templates could be offered for the students to use in the data driven system. Pre-designed as well as customizable templates could be chosen as options for PDP display. This would begin to accommodate the individual design needs of the students without forcing them to re-enter their content.

Summary

In the development of the PDP model, both the process and the outcomes provided positive benefits to the students and the faculty. The students, through the committee, took ownership of the development of the PDP model. In addition, both the students and the faculty had their needs met through the analyses and recommendations developed by the committee. More work in needed in the development of this model, but the committee has developed a solid framework to guide future exploration.

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Organizational Alignment Supporting Distance Education in Post-secondary Institutions

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Abstract

Leveraging Internet technologies, distance education is enjoying a renaissance of sorts. With its newfound popularity come greater resources as well as higher expectations and greater scrutiny. If distance education programs are to support their dramatic growth and outlive the hype, they must demonstrate performance results. Performance, however, does not just happen. High quality organizations actively support performance through processes, structures, and feedback systems that are aligned with organizational goals. In presenting recommendations for performance-oriented approaches, an established model of organizational alignment is applied to distance education in postsecondary institutions. The model facilitates the analysis of goals, structure, and management practices across the organization, its processes, as well as the work and workers involved. Also presented are performance improvement strategies such as benchmarking and documenting workflows, setting clear expectations, and developing feedback systems. Distance education practitioners can use the organizational alignment model and the strategies discussed to design a new program or transform an existing one.

Introduction

Onto the Web we go

Though distance education has been around in various forms for many years, it is only recently -- with the emergence of web-based delivery platforms -- that it has become the center of so much attention (Foshay & Moller, in press). "Where distance education used to suffer from benign neglect, now everyone wants to have a say in how (it) is used, controlled, and managed" (Sachs, 1999: p.75). Many institutions that previously ignored distance education altogether, are now rushing to deploy their own online programs in an effort to curb damage to their enrollments and possibly their reputations.

New entries

Post-secondary institutions face leveling student enrollment and rising competition from several directions. Previously viewed as relatively insignificant outreach projects, distance education programs (often from smaller schools) are taking more and more students away from large, regionally dominant schools. Institutions can no longer take for granted the geographic boundaries, or "turfs," that enabled them to virtually monopolize their regions. For-profit educational institutions (e.g., University of Phoenix) are becoming more commonplace and are beginning to gain accreditation. Also, there is an increasing number of professional certification programs, which more and more "free-agent" learners are using in lieu of matriculated programs to gain entry into the workforce and to increase their marketability (Foshay & Moller, in press).

Veterans transitioning to the Web

Those colleges and universities that long ago embraced distance education (through print, audio, and video technologies) face critical challenges also. Stay within their niche of experience and face possible obsolescence? Or, "take arms against a sea of troubles" and embrace the Internet (with computer mediated communication tools) as the vehicle of choice for distance education? The latter presents significant restructuring and reengineering challenges.

Current online programs

Though many institutions have decided to take the plunge into web-based distance learning, few have found a winning recipe for success. In fact, in the rush to move courses online, front-end analysis and planning are often first to be discarded for the sake of expedience. It seems that in at least some cases, distance education administrators are taking the 'hare' approach, figuring that just this once, they will win the race against the tortoise.

Distance education in the spotlight

In a Department of Education survey (1997-98), 20% of the respondents -- 990 post-secondary institutions -- reported that within three years they planned to join the 1,680 schools offering online distance education courses (NCES, 2000). With about 54,000 courses available over the web in 1998, serving 1.6 million students, and with relatively low economic barriers to entry, instead of asking 'Why distance learning?' many university presidents are asking 'Why not?'

With increased attention from university presidents comes more resources and higher status as well as higher expectations and greater scrutiny. Expectations typically take the form of business results: increased enrollments, lower operating costs, and (in some organizations) higher profits. Greater administration commitment and scrutiny ensures that in order to thrive in today's more businesslike post-secondary institutions, distance education programs must demonstrate business results. Otherwise, they risk eventual outsourcing, re-structuring, and (perhaps worst of all) divestiture. A new, results-oriented approach is needed to assure that distance education efforts are focused on goals that are in alignment with the institution's mission.

Towards business results: A human performance approach

Administrators who recognize the need to instill a results-oriented mindset in their distance education departments may find it helpful to examine proven strategies from the field of human performance technology ("HPT"). HPT draws from a variety of other fields, including management sciences, organizational development, instructional systems design, and quantitative analysis. Figure 1 lists several of HPT's core principles. The strategies that have evolved from these principles are as diverse as HPT's origins. Harmon (1984) provides a hierarchical structure for organizing HPT strategies. These encompass high level, organizational solutions such as total quality management ("TQM") and balanced scorecard evaluation systems as well as more grass roots, individual-oriented applications such as job re-engineering, performance support tools, and 360-degree performance evaluations. In general, HPT advocates measuring actual performance; comparing results against pre-set goals; and implementing systems, processes, and practices that are vertically aligned with those goals. Considering the seeming lack of clear goals, long-term planning, and feedback systems that characterize distance education today, applying an HPT approach may shed some light on best practices for establishing a successful program or transforming an existing program into a results-oriented organization.

Figure 1. Human Performance Technology core principles

1. HPT distinguishes between behavior (what someone does) and performance (measurable results achieved), and focuses primarily on performance.
2. Diagnosing performance problems involves measuring the gap between current and expected performance.
3. All performance problems stem from the worker, the environment, or a combination of both.
4. Processes depend on people to make them work, but people are not productive when they are in bad processes.
5. Organizations are open systems with inputs, outputs, processes, and feedback systems. Management, development, and systems functions affect all organizational performance.
    - Management functions guide and control the organization's processes and people through feedback, coaching, reprimands, and incentives.
    - Development functions improve the abilities and capabilities of workers through training, mentoring, and other developmental activities.
    - Systems components are the variables in the work environment that affect performance such as work processes, standard operating procedures, policies, practices, feedback mechanisms, reward structures, etc.

6. Exemplary performance should be used to benchmark workflows, set optimal performance levels, etc.

6. Rather than seeing HPT solutions as expenses, they should be viewed as investments and return on investment ("ROI") calculated for all significant expenditures

Adapted from Rothwell (1996: pp 30-32)

An organizational alignment model

Rummler & Brache's Organizational Alignment Model (1990) provides a useful framework for analyzing and aligning the goal-setting, structure, and management practices of an institution, its distance education processes, and its staff members. An analysis matrix has been adapted from this model and is shown in Figure 2. The nine cells of this matrix form the nine focal points for analysis. A similar approach involving organizational alignment analysis has been used to analyze parallel issues in training and e-learning contexts (Moller, Benscoter, Rohrer-Murphy, 2000; Prestera & Moller, in press). The model will be applied here in the context of distance education both to the question of what is and what should be present to support the goals, structure, and management of distance education programs. Recommendations, often founded in human performance technology (HPT) and organizational behavior literature, will also be presented.

Figure 2. Organizational Alignment Model

	Goals	**Structure**	**Management**
Organization	*Cell 1* – What will training contribute to the institution's business goals?	*Cell 4* – How should we structure the distance education group to meet the institution's business goals?	*Cell 7* – How will we measure and improve contributions to business goals?
Process	*Cell 2* – What are the key success factors for delivering distance education such that they meet the business goals?	*Cell 5* – How should workflows be structured in order to drive success?	*Cell 8* – How will we measure and improve the process?
Job/ Performer	*Cell 3* – What do we need from staff members in order to achieve our process goals?	*Cell 6* – How should roles and responsibilities be defined in order to meet expectations and deliver process results?	*Cell 9* – How will we measure and improve individual performance on the job?

Adapted from Rummler & Brache (1990)

Goals

Rothwell (1996) defines a goal as "a target for achievement… difficult to measure or to achieve in an identifiable time span… developed directly from an organization's mission or purpose statements." (p. 115). Goal-oriented by nature, human beings often set goals in pursuit of loftier purposes, reaching out towards visions of a better future. It should be of no surprise then that in the workplace, higher performance is possible when workers know what goals they should achieve and are confident in their ability to achieve them (House, 1971). Therefore, distance education administrators should set departmental goals that are in alignment with the institution's mission, perceived as achievable, and well-communicated to staff members.

In practice, however, departmental and organizational goals rarely seem to possess these traits. Distance education initiatives are often undertaken with at best only token consideration of institutional, logistical, and instructional needs (Blumenstyk, 1996). When program goals do exist they are often tied closely to misperceptions, which ultimately undermine the success of the initiative. In other instances, goals do not align with the program's processes and/or they are not communicated properly within the program. In this section, an argument is presented for establishing results-oriented goals, benchmarking successful process goals, and clearly communicating performance expectations for distance education staff.

Cell 1: Organization goals

Many managers both in the corporate world and in non-profit organizations manage their organizations with only one or two broad performance indicators, which offer limited help in diagnosing performance gaps, are typically too broad for individual workers to feel accountable for them, and generally create a sense of tunnel vision.

Recommendation 1A: Use balanced approach to goal setting

For decades, managers have sought out the "magic number," the one indicator that accurately measures the health of their organization. Net income, earnings per share, economic value added, and the other financial measures are widely used in for-profit organizations. Enrollment figures are typically used in academic settings. However, a new paradigm in the area of performance measurement has arisen in the last ten years. It asks the question, "What are your organization's key success factors?" and "How can you assess your organization's performance in those areas?" Kaplan and Norton (1996) categorized these factors into four dimensions of performance: learning, operating efficiency, customer satisfaction, and financial success. Having only one performance measure, the authors assert, is like driving a car with no other indicators but a fuel gauge. In distance education, organizations should move beyond enrollment targets and set goals that – as a group – paint as complete a picture of performance as possible. Figure 3 lists some possible success factors that could be part of a distance education balanced scorecard.

Figure 3. Possible balanced scorecard goals for distance education

Customer Satisfaction Goals	• Improve access - To improve access to instruction for workers whose schedules do not permit enrollment in traditional classroom programs (e.g., night shift crews), are geographically dispersed, or economically challenged. • Individualize instruction – Individualize instruction through blended course offerings (that combine delivery methods) and individualize content selection. • Lifelong learning - To support continuous learning, sustaining learning experiences beyond the time constraints of the classroom. • Employer relations – How can we improve employer perceptions/acceptance of distance education degrees so that students with such degrees are perceived as just as qualified, if not more qualified, than resident students. • Collaboration - To provide collaborative educational opportunities (see discussion groups, CSILEs, and CSCWs).
Operating Efficiency Goals	• Delivery efficiency - To organize, update, and distribute content efficiently and effectively through knowledge management systems (see reusable information objects and reusable learning objects). • Reducing downtime – What steps can be taken to reduce student/faculty downtime caused by technological constraints (e.g., bandwidth) and system errors. • Scheduling flexibility - To improve flexibility in scheduling for faculty and content experts, enabling them to leverage their time.
Learning Goals	• Innovate instruction – Distance education programs can act as testing ground for performance-based assessments, new learning paradigms, and instructional strategies. • Faculty development – As part of the design and delivery process, faculty will develop new medium-specific skills and may improve their overall teaching skills as well.
Financial Goals	• Operating costs - To reduce costs for the student, the school, and the faculty. • Profit – With for-profit organizations, this will inevitably be a measure.

Recommendation 1B: Assess needs of distance education stakeholders

As part of identifying the goals and measures to be included in this scorecard, distance education programs should assess the needs of all stakeholders, including potential and existing students, faculty, administration, and the IT department. For example, though distance education is gaining acceptance among students, it is by no means mainstream. In fact, the non-traditional students who would typi[illegible]y enroll in distance education courses are still the in the minority (Young, 2000). As marketing researchers know firsthand, there is a significant difference between a consumer's willingness to buy a product or service (acceptance) and their actual motivation to buy it (demand). Assessing the demand for distance education courses (through surveying, pilot studies, etc.) should precede any distance education enterprises. Similarly, student needs regarding content, interface, technical support, scheduling, etc. should be assessed as well. McIsaac (1998) contrasts the U.S. model of distance education with the needs-based approach of non-U.S. institutions.

> "Many countries have identified educational needs and have designed distance learning delivery systems to meet those needs. Conversely, it appears that educators and administrators in the U.S. have discovered broadband communication technology and are searching for ways to use the technology to compete for students in the higher education market and to cut costs. (p.24)"

Recommendation 1C: Communicate goals and measures

Once the program's goals and measures – which should be aligned with the institution's mission – are set, they should be communicated to the entire college or university with support from the President. Support from the top is critical in moving the program past gridlock. This is especially true for distance education programs since their activities must (by their very nature) cross geographic/departmental boundaries and consequently traverse many political obstacles. In describing the success of the distance education program at Northern Virginia Community College's, Sachs (1999) singled out public support from the President as "a key ingredient" and wrote that "This frequently meant discussions were not stuck on 'whether' to do something and moved to 'how to do it. (p. 68)."

Cell 2: Process goals

"Place a good worker in a flawed process and the process wins… every time" (Rummler & Brache, 1990). This truism underscores the importance of establishing a sound operational process for developing and delivering distance education courses. Identifying the goals of a distance learning program requires careful planning and an eye towards the future. Unfortunately, as Simerly (1999) points out, "today's organizational planning must occur in an environment of unpredictability that usually does not proceed in linear ways… (with) key stakeholders often (having) conflicting points of view regarding the planning process and its outcomes" (p.42). With the rise in acceptance of distance education comes greater internal conflict, as more stakeholders are involved, each jockeying for authority over online resources. Also, distance education programs are often in such a hurry to move content online that workflows are rarely documented, measured, or evaluated. Without clear process goals, however, consistency, accountability, and collaboration are jeopardized. If each member of a design team, for example, has a different idea of how the design process is supposed to work – and there is no documented way of doing things – time will be wasted and quality may even be compromised. In addition, without documenting workflows, there is no means to retain 'lessons learned' and other valuable organizational learning.

Recommendation 2A: Benchmark workflows

With the rise of Total Quality Management, many organizations are benchmarking their internal and external processes (Rothwell, 1996). Though quantitative sources of data for online distance education are scarce, there are some benchmarking reports, case studies, and guideline recommendations available. Carnevale (2000) describes a benchmarking study of six institutions with strong distance education programs, conducted by the Institute for Higher Education Policy (an executive summary can be downloaded at http://www.ihep.com/qualityonline.pdf). Twenty-four benchmarks for online distance education are provided, including the importance of online interaction with instructor and other students. Another source, described by Young (2000), is a faculty report written by 16 professors, which takes a critical look at distance education. The report, for example, recommends against the implementation of complete undergraduate degree programs for traditional students, citing student need of "personal socialization" (this report, titled 'Teaching at a distance' is available online at http://www.vpaa.uillinois.edu/tid/report/). Also, several authors provide recommendations and guidelines, often based on practical experiences (Trentin, 1998; Sachs, 1999; McIsaac, 1998; Collis, 1999; Evans, 1999; Prestera & Moller, in press).

Benchmarking questions to be answered include:

- What should be happening in course development and delivery that will improve how staff members perform?
- What should be happening to meet or exceed student expectations of their online course experience?
- What resources will staff members need in order to perform optimally?

Cell 3: Work/Worker goals

An examination of what should be happening with work and workers means identifying the competencies needed to achieve the department's process and organizational goals. Competencies are often examined in the context of job descriptions, performance standards, and feedback mechanisms.

Recommendation 3A: Write or re-write job descriptions

Job descriptions document work/worker goals and are an excellent means for communicating expectations. In developing job descriptions, distance education administrators should benchmark the roles, competencies, and performance outputs; compare those against the department's current skill set; identify any gaps that exist; and develop a strategy for acquiring those competencies. This may involve hiring new individuals with the right skills, re-engineering jobs, and/or developing skills through training, mentoring, practice, and other developmental activities. In a survey of 103 distance education experts, Thach and Murphy (1995) identified the principal roles, skills, and outputs required to deliver distance education. Administrators can use these results as a basis for assessing competencies within their departments. The study identifies eleven roles, which are listed along with their descriptions in Figure 4.

Figure 4. Summary of 11 distance learning roles

Role	Description
Instructional Designer	Work with instructors and/or SMEs to design courses, revise existing courses to fit distance learning environment
Instructor	Lead instructional design effort, facilitate course delivery, monitor and evaluate learner performance
Technology Expert	Advise in selection of distance learning technology, ensure reliability of technology, assess future changes in technology
Technician	Keep equipment in running condition, respond to users' questions and problems
Administrator	Manage staff and operations, balance budget, market distance learning programs
Site Facilitator	Assist students in learning at remote sites, distribute/collect materials/assignments, proctor tests
Support Staff	Register students, communicate course schedule/descriptions, coordinate support services
Editor	Edit course content for style, clarity, grammar, and structure. Arrange text layout for presentation
Librarian	Provide library assistance to students, assist with searches, delivery materials to students
Evaluation Specialist	Provide tools and evaluation instruments, monitor program success/problems, consult instructor about evaluation
Graphic Designer	Design attractive, clear layout, ensure materials facilitate learning

Adapted from Thach & Murphy (1995: p. 67-69)

The list includes primary roles (namely, instructors, instructional designers, technology experts, and administrators) as well as supporting roles, such as editors, librarians, and graphic designers. General interpersonal skills, such as communication, collaboration, and teamwork, as well as other more role-specific skills are listed in conjunction with expected performance outputs. These may serve well as benchmarks for writing job descriptions, recruitment profiles, and performance goals. They can also guide the use of development plans and the implementation of certification programs for distance education faculty, instructional designers, etc.

For veteran distance education programs, some additional issues include:

- Do current workers have the technical and interpersonal skills to work effectively with faculty in developing online courses?
- Do supervisors have the necessary skills to deal with the complex political issues of a growing distance education program?

Recommendation 3B: Link goals to reward system

"People will do what they are rewarded for doing" (Rothwell, 1996: p.257). Though this truism seems relatively obvious, there are still managers around who seem to believe that people perform simply to keep their jobs or out of a sense of loyalty. There are few examples that better demonstrate this than faculty in distance education. Before distance education became an overnight sensation, practitioners were primarily faculty who volunteered. Now, with many faculty being asked to teach online, resistance is on the rise (Dillon & Walsh, 1992). At many universities, and particularly land grant institutions, faculty are evaluated, promoted, and rewarded based primarily on their research, and to a lesser degree, classroom teaching and outreach services. Few schools offer rewards for teaching distance education courses (Wilson, 1998: Wolcott, 1997). In fact, at some universities, distance education faculty earn less credit for teaching than their classroom counterparts (Wolcott, 1997). Expectancy theory tells us

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that if faculty value their rewards, and if they feel capable of teaching distance education courses, then performance expectations and rewards will motivate them to teach online (Vroom, 1967). To the extent that distance education is a priority for the institution, administrators should align distance education goals with the university's feedback and reward systems. An example of this may be to give more weight to the development and delivery of distance education courses as a criteria for tenure.

Structure

Performance occurs within the imaginary boundaries of organizational structures, standard operating procedures, and inter-personal relationships. Unlike goals and management practices, structure typically cannot be changed quickly or easily. Formal embodiments of structure, such as titles, operations manuals, and organizational charts can be changed overnight, however, informal structures (norms and values) are ingrained in the organization's culture and are therefore more difficult to transform. Nevertheless, sometimes change they must. With distance education receiving more attention from institutions, governments, and students there is greater pressure to increase enrollment, quality, and speed. In other words, distance education departments may need to focus on performance more than ever before, even as they expand to accommodate a greater number of courses, faculty, and students.

Cell 4: Structuring the organization

The structure of a distance education department relative to the university or college it serves communicates to all members of the institution the relative importance and scope of distance education. Mark (1990) distinguishes four types of structures, a distance learning program, unit, institution, and consortium. With a program, distance education courses are developed entirely by the faculty of an academic department. A distance learning unit is a separate entity operating inside of a college or university. Usually, the unit will have its own full-time staff, which is completely dedicated to developing distance education courses (e.g., Penn State's WorldCampus). A distance learning institution is a wholly separate entity (e.g., British Open University) with its own faculty, administrative, and supporting units. Its sole purpose is the development and delivery of distance education courses. A consortium is an alliance involving two or more institutions or units, which share design and/or delivery resources.

Recommendation 4A: Align structure with goals and resources

The structure selected depends on the institution's goals and its resources. Wilson (1998) writes that "distant courses require three to four times more dollars to develop and three to eight times more faculty (time) and support personnel resources" (p. 3). If true, institutions that seek cost savings from distance education should create sufficient economies of scale to overcome the up-front fixed costs of developing and delivering distance education courses.

Sachs (1999: p.68) recommends the distance learning unit structure over the program, citing several benefits:

- Receives permanent status
- Is allocated a budget
- Has formal representation on committees
- Serves the entire college or university
- Pools distance education resources and knowledge
- Scalability - can expand or contract as needed
- Allows for economies of scale
- Allows for development of complete degree programs

Another benefit of the unit structure is that it enables distance education administrators the flexibility to set goals that cross service area boundaries and impact the entire institution, not just one academic department. Downsides to this structure include increased overhead, possible jealousy from other service areas that compete for budget allocations, and resentment from those departments over their loss of control over distance education resources.

Establishing a separate distance learning institution is one way to avoid some of the political and budgetary obstacles involved with internal units. An institution, acting as a subsidiary, affiliate, or independent of a resident university or college has its very own budget and most of its resources are self-contained. This enables it to be more agile, flexible, and responsive to changing student needs and organizational goals. Carr (2000) reports that universities, such as Cornell, Temple, and NYU, have established for-profit online subsidiaries for these same reasons.

Cell 5: Structuring the processes

Process structures are commonly operationalized through policies, practices, and standard operating procedures. These structures help a distance education unit maintain consistency in its workflows and outputs, document organizational learning, and accelerate the ramp up time for new hires. One method for developing good processes involves comparing current practices against benchmarked "best practices" collected from successful programs and then identifying any "disconnects" in the workflows. This process of comparison can identify opportunities for improving the efficiency and effectiveness of key distance education processes such as instructional design and class facilitation (Moller, Benscoter, & Rohrer-Murphy, 2000).

Recommendation 5A: Empower faculty

One benchmark of successful distance education processes is faculty involvement (Carnevale, 2000; Young, 2000). Sachs (1999: p.68) points out that by giving faculty a sense of ownership in the course development process, distance education units can:

- Reduce faculty turnover
- Improve design flexibility
- Encourage continuous improvement
- Increase the credibility of their program
- Create a direct pipeline into mainstream activities
- Eventually reach a status of 'accepted' in the institutional culture

The challenge for distance education staff is instilling the faculty with a sense of ownership while still maintaining some control over the quality and speed of the process. As Sachs (1999) described, "Some faculty were not adept at taking advantage of the new technology tools at their disposal" (p.70) and therefore require support from instructional design and technology experts to optimize their use of computer-mediated distance learning technologies. In order to achieve this balance of faculty control and expert guidance, processes should be structured in such a way that faculty, designers, and technologists work hand-in-hand as a team to produce a course. Interdependence is critical in combating the silo effect, where functional performance is maximized at the expense of the department's overall effectiveness (Rummler & Brache, 1990).

Other benchmarks will raise similar issues of process design, such as:

- How will decisions be made regarding the adoption of new technologies?
- How will current courses be revised to work with new technologies?
- What supporting processes will be outsourced?
- How will faculty be selected and certified?
- How will student performance be assessed?
- How are courses going to be selected for online delivery?

Cell 6: Structuring the job

The structure and organizational design of a distance education unit will impact the performance of the department as a whole as well as the effectiveness of individual staff members (Moller, Benscoter, & Rohrer-Murphy, 2000). Rothwell (1996) suggests that redesign efforts may be needed "if the external environment becomes more unstable because it is becoming more competitive or if the internal environment becomes more unstable due to changing work methods or relationships" (p.228). Given the dynamic nature of external environments, distance education administrators would do well to design or redesign their organizations in such a way as to maximize flexibility and responsiveness.

Traditionally, distance education was developed in small teams, typically consisting of an author and an editor. This author-editor model was fast and inexpensive, however, with neither of the participants having instructional design expertise, courses often lacked instructional quality (Moore & Kearsley, 1996). With the advent of more complex technologies (e.g., videoconferencing and computer conferencing) and greater investment into distance education, teams expanded to include producers, instructional designers, technologists, graphic artists, librarians, and other specialists. With increasing project complexity, higher stakes, and more specialists involved, development time and costs increased exponentially. Development cycles of over one year were not uncommon with this course team model.

Recommendation 6A: Structure jobs to optimize quality and efficiency

There are several other types of design models that organizations can use, including functional, divisional, project, matrix, and virtual design models. Traditional functional and divisional hierarchies may lack the flexibility and responsiveness needed in today's changing distance learning marketplace. The project structure emphasizes the role of project managers who lead temporary projects as the need arises. This may be suitable for fledgling programs that are looking to broaden support for distance education, but it does not lend itself well to long-term projects such as establishing entire online degree programs.

Matrix Model

The matrix design offers some possibilities for organizing distance education efforts. Distance education workers would have two immediate supervisors: the lead for their particular area of expertise (e.g., Instructional Design Lead) and the project managers they work with to develop courses. This model is frequently used by service organizations. In fact, many courseware development firms are organized this way. The design has inherent flexibility, responsiveness, and attention to quality, which can be critical in dynamic, client-oriented environments. On the other hand, this structure can often confuse staff members because of its complexity, its often conflicting priorities, and added layer of management. Another drawback is that by having project managers, whose job it is to plan, coordinate, and control, it may be difficult to instill a sense of ownership in faculty members.

Virtual Model

The virtual design is often seen as the design of the future, with its emphasis on temporary skilled workers, vendors, external consultants, and suppliers. This design of tomorrow is in fact the design of today for the film and television industries. Producers assemble directors, writers, cast members, set designers, as well as other support resources, vendors, and consultants as needed to work together for a limited time. Often, there are some full-time employees but only as many as absolutely necessary. One of the main drawbacks of outsourcing core competencies is the loss of benefits from organizational learning. In distance education, over-use of vendors, external consultants, and temporary help may not sit well with faculty and certainly will do little to build long-term relationships and acceptance within the institutional culture.

Consultant Team Model

Another possible structural design is the consulting team model. In this approach, faculty members lead the development effort and are assisted by instructional design and technology internal consultants. Other support staff members are also involved and may include some vendors, external consultants, and temporary workers. This model can be particularly effective if work processes are geared towards using reusable learning objects, templates, and centralized depositories of reference, content, and assessment materials. These would minimize the amount of customization required for each course and reduce the need for large full-time staffs of specialists. Olcott and Wright (1995) argue against such faculty-centered models, writing that: "distance education has both a responsibility and a unique opportunity to foster a student-centered learning process responsive to the diversity of adult learners" (p.14). Striking a balance between student needs and faculty control can be a difficult proposition for the distance education staff. However, alienating faculty by removing curriculum control and classroom autonomy may, in the final analysis, contribute little to improving the learning experience for the student.

Management

The purpose of management is to put the right people, systems, and resources in place to succeed; assess performance; provide feedback; and take action to maintain alignment with established organization, process, and job performance goals. Key issues to be addressed include:

- Are there feedback systems that help diagnose performance deficiencies?
- Are the right people in place in sufficient numbers and with the right resources to work effectively? In other words, are staff members motivated to perform?
- Are there consequences for negative performance as well as rewards for positive performance results?
- Are expectations, roles, and standards clearly communicated throughout the organization?

Cell 7: Managing the organization

In managing the distance education department, administrators should set milestones, measure performance, and ensure consistent alignment with the institution's mission. Distance education's contribution to the organization should be assessed and weighed against costs and organizational needs. Currently, the proliferation of online distance education courses is precariously perched on several assumptions. Sachs (1999) summarizes them, writing:

> "Distance education courses are being developed because there is a perception that there are a large number of students to be gained, often at the expense of other institutions; that it will be cheaper to serve students; or that it will be easier to teach because there will not be class meetings. (P.77).

Recommendation 7A: Conduct cost analysis

Though the debate continues, there is no conclusive evidence to show that online courses are cheaper or easier to implement than traditional classroom instruction. Therefore, cost justifications for distance education should be used cautiously, if at all. Results in business and academic settings indicate that distance learning efforts can reduce costs but too often bring more economic pain than gain (Fornaciari, 1999). A thorough cost analysis may help administrators reduce the economic uncertainty involved and should help them set realistic goals for the distance education programs. Whalen and Wright (1999) offer a framework for cost analysis that can be used to:

- Predict the number of students needed for a program to break even
- Identify the fixed and variable costs involved
- Identify realistic program life spans (time in use before requiring revision)
- Identify the opportunity costs involved
- Compare the development costs for the alternatives available

Rumble (1999) and Jewett (2000) provide similar cost analysis models.

Recommendation 7B: Identify the benefits/goals to be achieved

Distance education potentially offers significant benefits both to the institution and its students. Figure 2 is a partial list of these benefits. Though competition for enrollment and reduced costs are possible macro-benefits, or goals, of distance education, some schools are finding that flexibility is the single, greatest reason to implement it. Schools in Australia, for example, have taken to using the term "flexible learning" to describe the concurrent (dual-mode) usage of distance learning and classroom instruction. As Evans (1999) points out: "The viability of an educational institution is not just a matter of costs. It is also a matter of making judgments about community needs and obligations and state or national priorities" (p.41). Collis (1999) describes the growing movement in Europe towards improving flexibility of location as part of a broader effort to individualize education through flexibility in content selection, learning resources, technology use, and the amount and type of communication. Student-oriented goals such as these can help the university at-large to deal with shifting demographics, changing societal needs (e.g., lifelong learning), and growing competition from non-traditional educational and certifications programs. Also, making flexibility an organizational goal mandates changes throughout the institution and positions the distance education program as an important change agent and resource.

Cell 8: Managing the processes

Design and delivery processes should be benchmarked against established Instructional Systems Design (ISD), Human Performance Technology (HPT), and distance education best practices. For example, the standards developed by the International Board of Standards for Training Performance and Instruction (IBSTPI, 1998) can form the basis for the department's process standards as well as help in the development of hiring, training, and evaluation programs for instructional designers.

Recommendation 8A: Assess resource usage

Managing the process also means allocating the right type and right amount of resources. Distance education resources include technology (hardware, software, infrastructure), skills (ISD skills, technical know-how), funding (for outsourcing, updating systems, etc.), material (e.g., not enough desks), and human resources (not enough people or time to do the job, the wrong skill sets for the job). In order to make educated decisions about resource allocation, managers should put systems into place that assess resource usage.

Recommendation 8B: Assess the efficiency of workflows

In a survey of faculty member attitudes toward distance education, Rockwell, Schaer, Fritz, and Marx (1999) found that 57% of faculty members viewed release time as an incentive and ranked time requirement as their number one obstacle (p.6). With more and more faculty being asked to deliver courses online, the debate is under way: does it take more or less effort and time to develop and deliver a distance education course? A survey of distance education faculty, found that 53% believed that the distance courses required more work than resident classes (NEA, 2000). In a case study comparing a traditional class and an online course, Visser (2000) found that development and delivery time for the online course significantly exceeded those of the traditional course. DiBiase (2000) found contradictory results in a similar comparison case study. However, he did observe that the frequency of contact for online coursers is higher (5 times per week) than traditional courses (4 times per week). Considering the narrow margin of difference in the NEA study (44% felt it takes less work) and conflicting results of the case studies, this may be an issue that cannot be resolved in generic terms. Rather, each distance education department should formalize processes for assessing the amount of time needed to develop and deliver courses as well as the relative quality of those courses. In light of those results, a more accurate evaluation can be formed and, when necessary, steps can be taken to reduce the amount of time and effort required of faculty. Though faculty release time is important from the standpoint of faculty morale, it is even more critical from the standpoint of quality. Faculty and the specialists who support them need to have sufficient time for design, development, and delivery. There should also be formative and summative evaluation of courses to help team members adjust their outputs and continuously improve their courses. As Moore (2000) points out: "it's not a question of having less work or more work…, but (rather) getting better quality out of the same effort as a result of that effort being more effectively organized and applied" (p.5).

Cell 9: Managing the job/workers

Managing a distance education staff can be a challenging job. Not long ago, distance education courses were created by small teams of two to three people. Today, given the complexity of technology-based instruction, distance education programs rely on a variety of specialists. How will these specialized workers be managed? Who is best qualified to manage them and evaluate their performance? Given the specialized nature of their work, will staff members need to be evaluated against performance standards for their given fields or should they be held accountable for more general team performance standards such as quality, speed, and costs? How will staff members receive feedback for their individual and/or team performance? Thomas Gilbert (1978) points out that "more than half of the problems of human competence can be traced back to inadequate (feedback) data" (p.179).

Recommendation 9A: Performance standards

Performance standards act as an anvil against which performance is shaped. Without standards, it is difficult, perhaps impossible, to distinguish consistently good performance from bad, skilled workers from poor ones, and best practices from sub-optimal procedures. Performance standards provide an objective basis for performance-oriented feedback mechanisms.

Recommendation 9B: Feedback mechanisms

Rothwell (1995) found that feedback-related strategies make up 3 of the top 4 most frequently encountered human performance improvement interventions. This reflects the paramount importance of information and communication in an organization. Feedback helps with "goal refinement, documentation, determination of impact, and program improvement" (Hawkes, 1996: p.31). Distance education administrators should establish mechanisms for clear and timely communication of roles, responsibilities, performance expectations, performance results, and any information that is pertinent to the work of developing distance education courses. Without such information, performance suffers. On the other hand, "significant performance gains can be achieved by improving the flow of information about the work" (Rothwell, 1996: p.186). Sources of performance feedback include student comments about their experiences, help desk logs, budget-to-actual reports, and peer evaluations.

Conclusion

Distance education in postsecondary institutions is seeing dramatic growth. Is this upsurge an anomaly or is distance education a force that will stand the test of time and succeed in bringing about profound changes in the way we teach and learn? Though we cautiously subscribe to the latter, much will depend on distance education's ability to deliver results, not just in terms of bottom-line returns for institutions but also in terms of:

- Fruitful educational experiences for students
- Perceptions that employers have of students with online degrees
- True access across socio-economical classes and regions
- Adoption of innovative instructional approaches

This paper has examined the organizational alignment of distance education programs. Applying performance improvement strategies, recommendations have been presented for communicating goals, benchmarking processes, measuring results, providing timely feedback at all levels, and rewarding performance. A more complete summary is provided in Figure 5. Without a clear vision of performance goals, without plans for making the vision a reality, and without the structures and systems to manage performance, distance education administrators compromise organizational results and may realize only too late that performance does not just happen.

Figure 5: Summary of recommendations

	Goals	Structure	Management
Organization	*Cell 1* – Establish balanced scorecard with goals that are aligned with the institution's mission.	*Cell 4* – Determine the size and scope of the distance education organization.	*Cell 7* – Assess student and organizational needs. Evaluate results through cost/benefit analysis.
Process	*Cell 2* – Benchmark processes by identifying best practices for instructional design, development, and delivery of online courses.	*Cell 5* – Use benchmarks to set process standards and develop policies and practices to support performance.	*Cell 8* – Evaluate processes to determine standard resource usage levels. Use feedback to improve efficiency and quality.
Job/ Performer	*Cell 3* – Identify roles needed, responsibilities, and outputs. Tie performance goals to reward system.	*Cell 6* – Develop a workflow design that supports best practices.	*Cell 9* – Set employee performance standards, measure results, and use feedback to improve performance.

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Effects of Personalized Instruction on Mathematics Word Problems in Taiwan

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Abstract

This study investigated the effects of personalized instruction on the achievement and attitudes of Taiwanese students on two-step mathematics word problems. A total of 136 fourth-graders in a Taiwanese public school participated in the study. Subjects initially completed a Student Survey on which they chose their favorite foods, sports, stores, classmates, and other selections. The most popular items were then used to create personalized math word problems for the pretest, personalized instructional program, and posttest. Subjects were blocked by ability based on their pretest scores and were randomly assigned within ability levels to either a personalized or non-personalized version of the print-based instructional program. After finishing the program, subjects completed a student attitude survey and the posttest. A repeated-measures ANOVA revealed that subjects in the personalized treatment made significantly greater pretest-to-posttest gains than those in the non-personalized treatment. Subjects also performed significantly better on the personalized pretest and posttest problems than on the non-personalized problems. Personalized subjects and higher-ability students both had significantly more positive attitudes toward the instructional program than their non-personalized and lower-ability counterparts.

Introduction

Data from the National Assessment of Educational Progress (1992a, 1992b) indicate that mathematics word problems are difficult for students at all age levels in elementary and secondary schools. A major cause of the difficulty appears to be the students' inability to convert the problems into the math operations that must be performed to solve them (Hart, 1996). Some researchers have also noted that lack of familiarity with word problem structures may also contribute to poor student performance (Mayer, 1982; Rosen, 1984).

Personalizing mathematics word problems, such as incorporating personal background information into the problem content, can lead to improvements in performance (Anand & Ross, 1987; Davis-Dorsey, Ross, & Morrison, 1991; Lopez & Sullivan, 1991, 1992). Anand and Ross (1987) tested the effect of using computer-assisted instruction to personalize mathematics instruction for elementary school children. Students who received personalized instruction scored significantly higher on math word problems involving rule recognition and transfer than those whose instruction was not personalized. The authors claimed that personalized contexts increased students' comprehension and motivation by helping them interpret important information in the problem statement. Davis-Dorsey et al. (1991) found that both second-grade and fifth-grade students made significant achievement gains from rewording and personalization of the context in math word problems. In two separate studies with rural eighth-grade Hispanic American students, Lopez and Sullivan (1991, 1992) found significant overall achievement effects for personalization on one-step and two-step mathematics word problems.

Several studies have found that student attitudes are more positive when student interests and preferences are incorporated into instruction in order to personalize it. Ross and his colleagues (Ross, 1983; Ross, McCormick, & Krisak, 1986; Ross, McCormick, Krisak, & Anand, 1985) employed personalization in a series of adaptive instruction studies. Favorable attitude results were obtained when preservice teachers received education-related materials and nursing students received medical-related materials, and poorer results were attained when each group received the other's materials. Herndon (1987) found that high school students who received instruction based on common group interests had significantly more favorable attitudes and higher retur [illegible] to-task motivation than students whose instruction was not interest-based. Cordova and Lepper (1996) and Hart (1996) also found more favorable attitudes or motivation toward personalized than toward non-personalized instruction.

Researchers have offered two theory-based explanations for the effectiveness of personalized instruction in studies where it has yielded better results than non-personalization. One is that students' greater familiarity with personalized problem situations and content may enable them to solve problems more easily by reducing their cognitive load (Lopez & Sullivan, 1991, 1992; Miller & Kulhavy, 1991). This position is supported by D'Ailly, Simpson, and MacKinnon's (1997) statement that "self-referencing facilitates general encoding processes and decreases the load on working memory during problem solving."

The second explanation is based on interest theory (Mayer, 1998). Mayer notes that students exert more effort and are more successful solving problems that interest them than problems that do not. Several researchers have cited greater student interest and motivation as reasons for better performance under personalized instruction (Cordova & Lepper, 1996; Lopez & Sullivan, 1992; Ross & Anand, 1987). The "reduced cognitive load" and "increased interest" explanations appear to be compatible with one another rather than being alternative or competing explanations.

The present study was designed to address the unanswered questions from the Ku and Sullivan (2000) research and to investigate the stability of the other findings from that study and other research. The likelihood of a ceiling effect, which confounded interpretation of the personalization versus non-personalization issue in the earlier research, was reduced by conducting this study with fourth-grade students instead of fifth graders as in the earlier study. This study was also conducted with 136 students, or nearly twice as many as the earlier one, to increase the power of the statistical analyses. These changes were designed to provide a clearer answer to the question of whether instruction incorporating personalized math word problems would yield significantly better student performance than instruction using only non-personalized items.

The question of whether merely stating test items in personalized form would yield better performance than stating them in non-personalized form, irrespective of the type of instruction students receive, was addressed by including an equal number of personalized and non-personalized items on the pretest, as well as on the posttest. Including personalized and non-personalized items on the pretest, as well as on the posttest, in the present study was designed to permit more direct and stable comparisons of the effects of the two types of test items alone and in combination with the instructional treatments.

The present study investigated the effects of two levels of group personalization (personalized, non-personalized) on the achievement of fourth-grade Taiwanese students on two-step mathematics word problems. Mathematics ability level, as determined by scores on the pretest administered prior to the instructional phase of the study, was also included as a variable because it is an important factor in mathematics achievement and because of differential findings by ability level in earlier research on personalization (Dwyer, 1996; Ku & Sullivan, 2000; Lopez & Sullivan, 1991).

The primary research questions for the study were as follows:

1. Does personalization of instruction increase the achievement of Taiwanese students on mathematics word problems?
2. Does personalization of instruction have a differential effect on the performance of higher-ability and lower-ability students on mathematics word problems?
3. Do Taiwanese students perform better on personalized word problems than on non-personalized problems irrespective of the type of instruction (personalized or non-personalized) they receive?
4. Does personalization of mathematics word problems influence student attitudes toward the instruction on these problems?

Method

Subjects

A total of 136 fourth-grade Taiwanese students from four classes taught by different teachers at a public elementary school in Taiwan participated in this study. The school is located in a mid-level income and socioeconomic area in Fengyuan, a city with a population of approximately 160,000 people.

Materials

Student Survey. A 20-item student survey was used to determine the personal backgrounds and interests of the participants. Topics included the names of the students' favorite places, activities, sports, friends, convenience stores, foods, and so forth. Students wrote in two favorite responses for each survey item.

The survey was administered one week prior to the pretest. Responses to each survey item were tabulated by the experimenter and then used to design the personalized version of the instructional program and the tests.

Instructional Program. Two parallel versions of an instructional program on two-step math word problems were developed in print form in Chinese. Taiwanese students learn addition and subtraction in the third grade and multiplication and division in the fourth grade. The word problems in the instructional program and the test items were taken directly from the fourth-grade and fifth-grade mathematics textbooks used by the participants. The program was administered after the students had studied one-step multiplication and division, and it covered two-step processes that they had not yet formally studied.

The non-personalized version of the instructional program was written first and included standard problem types from the students' math textbook. The personalized version was then written by incorporating the most popular referents (places, foods, sports, names, etc.) from the Student Survey into the previously non-personalized version.

An example of a practice item in personalized and non-personalized form is provided below. The example item requires using multiplication followed by division.

Non-personalized:	The teacher has 2 dozen cans of soft drink to be shared equally by 8 students. How many cans of soft drink does each student get?
Personalized:	The teacher, Ms. Sue, has 2 dozen cans of milk tea to be shared equally by 8 students. How many cans of milk tea does each student get?

The instructional program covered procedures for solving two-step word problems involving four different combinations of multiplication and division operations (multiply-multiply, multiply-divide, divide-multiply, divide-divide) with whole numbers. A four-step strategy based on the work of Enright and Choate (1993) was incorporated into the instructional program for both treatments. The four steps, which had not been taught to the students previously, were: 1. Read the question. 2. Think through the problem. What must be found out? What steps are involved? 3. Choose the steps and do the math. 4. Check your answer.

Instruction for solving each of the four types of problems contained the four-part Enright and Choate strategy with two worked examples for each problem type. After the examples for each problem type, the instructional program contained two practice problems for the students to work. Each pair of practice problems was placed on a page with enough open space to allow students to work out the problems. When students completed the instructional program, the experimenter collected the programs and scored the practice problems. On the following day, the experimenter conducted a review in which he provided the answers to the practice problems and the explanations for them. All materials used in the study were in Chinese.

Procedures

The Student Survey was administered to participants two weeks prior to the treatment. The most popular choices (places, foods, sports, and so forth) from the survey were subsequently used to convert the non-personalized problems into the personalized content for the pretest, the instructional program, and the posttest. The pretest was administered one week after students filled out the Student Survey.

After the pretests had been scored, the subjects were blocked within each class by their pretest scores into higher-ability and lower-ability groups, and were assigned within blocks to either the personalized or the non-personalized version of the instructional program. Sixty-eight subjects each, 34 higher-ability and 34 lower-ability, were in the personalized treatment and the non-personalized treatment. The mean pretest score was 9.35 (SD = 1.65) for the 68 higher-ability subjects and 3.74 (SD = 2.11) for the 68 lower-ability subjects.

The experimental part of the study took place over three 40-minute class periods on three different days one week after the pretest. The experimenter served as the instructor for all treatments in regularly scheduled math classes in four different classrooms. The experimenter read instructions to all students and told them that they would be helping with the development of a new math program in Taiwan and that they should try their best to learn and to solve the problems. On the first day, subjects completed the instructional part of the program. On day two, the experimenter went over the eight practice problems with subjects and wrote the answers on the blackboard. After this review, students filled out the student attitude survey and teachers completed the teacher attitude survey. On the final day, subjects took the posttest.

Criterion Measures

Pretest. A total of 24 problems were developed, in both personalized and non-personalized forms, for the pretest and posttest. Twelve items, three from each of the four combinations of multiplication and division math operations, were randomly assigned to the pretest and the remaining twelve were assigned to the posttest. Thus, both the pretest and the posttest contained twelve two-step math word problems involving whole numbers. The problems on the pretest were in random order within each problem type and those on the posttest were in the same order by problem type. Each test consisted of three problems involving a multiplication operation followed by a second multiplication operation (multiply-multiply), three problems involving multiplication followed by division (multiply-divide), three problems involving division followed by multiplication (divide-multiply), and three problems involving division followed by a second division operation (divide-divide).

The pretest was constructed and named as two different forms, Form A and Form B. The total of 24 items were randomly assigned as 12 pretest and 12 posttest items as described above. In Form A, problems one through six were written as non-personalized problems and problems seven through twelve were written as personalized problems. In Form B, the non-personalized problems from Form A (problems one to six on Form A) were converted to the personalized problems seven through twelve, and the personalized problems from Form A (problems seven through twelve on Form A) were converted to non-personalized problems one through six. Thus, the same 12 items appeared in both personalized and non-personalized forms across the two test versions, with the six items in non-personalized form as items 1-6 on each form and the six personalized items as items 7-12 on each form. The answer to each problem was scored as correct only when the correct final answer to the problem was given. The KR-20 reliability coefficient was .83 for the pretest.

Posttest. As with the pretest, posttest problems were developed and administered in two forms. The first six problems on Form A of the posttest were in non-personalized form and the second six problems were in personalized form. The first six problems on Form B of the posttest were items seven to twelve from Form A in non-personalized form and the final six problems on Form B (Items 7-12) were items one to six from Form A in personalized form. Thus, the problems on Form A and Form B of both the pretest and the posttest consisted of six non-personalized items followed by six personalized items. Like the answers on the pretest, each answer on the posttest was scored as correct or incorrect only based on the final answer. The KR-20 reliability coefficient was .87 for the posttest.

Subjects who received Form A on the pretest received Form B on the posttest, and those who received Form B on the pretest received Form A on the posttest. The overall mean proportions correct for all subjects across both tests were .68 for Form A and .69 for Form B.

Student Attitude Survey. A ten-item attitude survey served as the criterion measure for assessing the students' attitudes and motivation. Eight of the ten items were four-choice Likert-type questions that assessed student attitudes and continuing motivation toward the instruction. These items dealt with such matters as how interesting and how easy the instructional programs was, how much students learned from it, whether students could do two-step problems well, and whether they would like to do more problems like those in the program. Responses to these eight items were assigned a score of 4 for the most positive response and a score of 1 for the least positive response. The two remaining items were open-ended questions dealing with student likes and dislikes about the instructional program. The KR-20 reliability coefficient for the eight Likert-type items was .70.

Teacher Attitude Survey. A seven-item teacher survey, consisting of six four-choice Likert-type items and one open-ended question, was used to assess teacher attitudes toward the instructional program and the personalization strategy. Items dealt with topics such as the appropriateness of the program, its quality, whether it helped students learn, the effectiveness of personalization, and whether the teachers liked personalization. Teacher responses to the Likert-type items, like those of the students, were scored from 4 (most positive) to 1 (least positive).

Data Analysis

The data analysis for student achievement was a 2 (Treatment: Personalization and Non-personalization) x 2 (Ability Level: Higher Ability and Lower Ability) x 2 (Test Occasion: Pretest and Posttest) x 2 (Problem Type: Personalized and Non-personalized problems) repeated-measures univariate analysis of variance (ANOVA). Treatment and ability level were between-subjects variables in the analysis and test occasion and problem type were within-subjects variables. Attitude data were analyzed using a 2 (Treatment) x 2 (Ability Level) x 8 (Survey Items) multivariate analysis of variance (MANOVA) for the overall survey means.

Results

The results are reported in this section for achievement, student attitudes, and teacher attitudes.

Achievement

The pretest and posttest data for the two levels of personalization, the two ability levels, the two test occasions, and the two problem types are shown in Table 1. The achievement data for each variable in the four-factor design are discussed below.

Treatment. For personalization level, the mean overall scores across the two test occasions were 8.45 (70%) for the personalized subjects and 7.93 (66%) for the non-personalized subjects. ANOVA revealed that the difference in mean scores between the two personalization levels was not statistically significant, $F(1, 132) = 2.37$, $MSE = 3.80$, $p = .126$. However, the difference for treatment in this analysis was reduced due to the fact that the pretest and posttest scores were combined for each of the two levels of personalization because of the repeated-measures design. The mean scores by personalization level on the pretest (that is, prior to the treatment) were identical for the two levels: 6.54 items correct (55%) for the personalized treatment and 6.54 (55%) for the non-personalized treatment. In contrast, the mean posttest scores by treatment were 10.35 (86%) for the personalized treatment and 9.32 (78%) for the non-personalized treatment.

The differential pattern of identical scores for personalization level on the pretest, but a higher score for personalization than for non-personalization on the posttest, was reflected in a significant treatment by test occasion interaction, $F(1, 132) = 8.27$, $MSE = 1.09$, $p < .01$, $\eta^2 = .06$. A post hoc paired-samples t test revealed that the posttest score of 10.35 for the personalized treatment was significantly higher than the score of 9.32 for the non-personalized treatment, $t(67) = 3.01$, $p < .01$.

Table 1
Mean Scores by Treatment, Ability Level, Test Occasion, and Problem Type

	Problem Type			
	Personalized		Non-personalized	
Test Occasion and Treatment	Higher ability	Lower ability	Higher ability	Lower ability
Pretest				
Personalized				
M	4.79	1.94	4.71	1.65
SD	(0.98)	(1.28)	(1.09)	(1.28)
Non-personalized				
M	4.85	2.18	4.35	1.71
SD	(0.96)	(1.24)	(0.98)	(1.22)
Sub-totals				
M	4.82	2.06	4.53	1.68
SD	(0.96)	(1.26)	(1.04)	(1.24)
Posttest				
Personalized				
M	5.82	4.59	5.85	4.44
SD	(0.46)	(1.84)	(0.44)	(1.74)
Non-personalized				
M	5.68	3.94	5.35	3.68
SD	(0.59)	(1.69)	(0.95)	(1.80)
Sub-totals				
M	5.75	4.27	5.60	4.06
SD	(0.53)	(1.78)	(0.78)	(1.80)

Overall mean scores by test occasion and variables:

	Treatment	Ability	**Problem Type**	
Pretest Personalized	= 6.54	Higher = 9.35	Personalized	= 3.44
Non-personalized	= 6.54	Lower = 3.74	Non-personalized	= 3.10
Posttest Personalized	= 10.35	Higher = 11.35	Personalized	= 5.01
Non-personalized	= 9.32	Lower = 8.32	Non-personalized	= 4.83

Overall Personalized	= 8.45	Higher = 10.35	Personalized	= 4.23
Non-personalized	= 7.93	Lower = 6.03	Non-personalized	= 3.97

Note. Total possible score equals 12 items correct on each test for treatment, ability level, and test occasion, and six items correct for each problem type.

Ability Level. Higher-ability students outscored lower-ability students across the two tests, 10.35 (86%) to 6.03 (50%). This difference for ability level was statistically significant, $F(1, 132) = 167.49$, $MSE = 3.80$, $p < .001$, $\eta^2 = .56$.

The 2 x 2 x 2 x 2 ANOVA also yielded a significant ability level by test occasion interaction, $F(1, 132) = 52.30$, $MSE = 1.09$, $p < .001$, $\eta^2 = .28$. This interaction reflected the fact that higher-ability students improved less from pretest to posttest than lower-ability students. Higher-ability subjects had mean scores of 9.35 (78%) on the pretest and 11.35 (95%) on the posttest, an improvement of 2.00 items correct, whereas lower-ability subjects had mean scores of 3.74 (31%) on the pretest and 8.32 (69%) on the posttest, an improvement of 4.58 items correct.

Test Occasion. The mean scores for test occasion were 6.54 (55%) for the pretest, and 9.84 (82%) for the posttest, a mean pretest-to-posttest increase of 3.30 items correct. This difference was statistically significant, $F(1, 132) = 338.85$, $MSE = 1.09$, $p < .001$, $\eta^2 = .72$. The two interactions that involved test occasion, treatment by test occasion and ability by test occasion, were reported above.

Problem Type. The overall mean scores for problem type were 4.23 (71%) for the six personalized problems and 3.97 (66%) for the six non-personalized problems, a statistically significant difference, $F(1, 132) = 17.63$, $MSE = .51$, $p < .001$, $\eta^2 = .12$. The ANOVA also yielded a significant two-way interaction for treatment by problem type, $F(1, 132) = 4.66$, $MSE = .51$, $p < .05$, $\eta^2 = .03$. This interaction reflected the fact that there was a rather small difference in the scores of subjects in the personalized treatment on the personalized and non-personalized problems (4.29, or 72%, on personalized items and 4.16, or 69%, on non-personalized items), and a larger difference in the scores of non-personalized subjects on these items (4.16, or 69%, on personalized items and 3.77, or 63%, on non-personalized items). Post hoc paired-samples t tests of the scores contributing to this interaction revealed that the mean score of 3.77 for non-personalized treatment on non-personalized items was significantly lower at the $p < .01$ level than the means of each of the other three groups.

Both personalized and non-personalized problems were included in the pretest in order to determine whether students would perform better on personalized word problems than on non-personalized problems prior to the instruction. The significant main-effect for problem type across test occasions indicates that subjects did perform better on personalized items than on non-personalized items both before and after they received instruction. Paired-sample t tests of the difference between scores on personalized and non-personalized items on the pretest and again on the posttest confirmed that significant achievement differences favoring personalized items occurred on both occasions.

Student Attitudes

The mean attitude scores by treatment and ability level for subjects' responses to the eight statements on the four-point Likert-type attitude survey administered after completion of the instructional program are shown in Table 2. Responses were scored as 4 for the most positive response to 1 for the most negative response.

The overall mean score across the eight Student Attitude Survey items was 3.42, a favorable rating indicating agreement with positive statements about the instructional program. The three highest-rated statements on the survey were "I learned a lot from this program" ($M = 3.71$), "It is important to know how to solve two-step math problems" ($M = 3.68$), and "I would like to do more math word problems like the ones in the program" ($M = 3.55$). The lowest-rated statement was "I am able to do two-step math problems well" ($M = 3.12$).

The data in Table 2 were analyzed using a 2 (treatment) x 2 (ability) x 8 (survey items) MANOVA to test for significant differences. A significant overall effect across the eight items was obtained for treatment, ($M = 3.52$ for personalization and 3.31 for non-personalization), $F(8, 127) = 7.10$, $MSE = .13$, $p < .001$, $\eta^2 = .08$, and for ability, ($M = 3.54$ for higher-ability students and 3.29 for lower-ability students), $F(8, 127) = 5.72$, $MSE = .13$, $p < .001$, $\eta^2 = .11$. The treatment by ability level interaction across the eight items was not statistically significant.

Univariate analyses on the eight survey items by personalization level revealed significantly more positive attitudes on four of the items for subjects in the personalized treatment than for those in the non-personalized treatment. Students in the personalized treatment had significantly more favorable scores at the $p < .001$ level on the items: "This program was interesting" ($M = 3.62$ for personalization and 3.24 for non-personalization, $\eta^2 = .09$), "This program was easy" (M = 3.50 for personalization and 2.85 for non-personalization, $\eta^2 = .19$), and "This program had many familiar persons, places, and things" (M = 3.62 for personalization and 3.13 for non-personalization, $\eta^2 = .11$), and at the .05 level on the item "I would like to do more math word problems like the ones in the program" (M = 3.66 for personalization and 3.44 for non-personalization, $\eta^2 = .04$).

Univariate analyses for ability level revealed significant attitude differences favoring higher-ability students on five of the items. Higher-ability students responded significantly more positively than lower-ability subjects at the .001 level to the statements: "I learned a lot from this program" (M = 3.91 for higher ability and 3.51 for lower ability, $\eta^2 = .14$), and "I am able to do two-step math problems well" (M = 3.35 for higher ability and 2.88 for lower ability, $\eta^2 = .11$), and at the .05 level to the statements: "This program was easy" (M = 3.32 for higher ability and 3.03 for lower ability, $\eta^2 = .04$), "I liked this program" (M = 3.44 for higher ability and 3.12 for lower ability, $\eta^2 = .05$), and "I would like to do more math word problems like the ones in the program" (M = 3.68 for higher ability and 3.43 for lower ability, $\eta^2 = .05$).

The frequency of constructed responses on the attitude survey to the two open-ended questions about what students liked most and what they liked least was also tabulated. Student responses indicated that what they liked most was that the program was interesting, a response given by 42 of the 136 students (31%). The second most common response to what students liked most was the use of the names of cartoon characters, persons, and things with which they are familiar, a response indicated by 38 students (28%). When asked what they liked least about the program, 48 students (35%) indicated nothing and 33 students (24%) responded that the lesson was too difficult.

Table 2
Student Attitude Scores by Treatment and Ability Level

	Treatment			Ability		
Item	Pers	Non-Pers	F	Higher	Lower	F
1. It is important to know how to solve two-step math problems.	3.65	3.72	.57	3.72	3.65	.57
2. This program was interesting.	3.62	3.24	13.24**	3.40	3.46	.29
3. This program was easy.	3.50	2.85	31.00**	3.32	3.03	5.41*
4. This program had many familiar persons, places, and things.	3.62	3.13	15.81**	3.49	3.26	2.99
5. I learned a lot from this program.	3.69	3.74	.22	3.91	3.51	20.85**
I am able to do two-step math problems well.	3.16	3.07	.52	3.35	2.88	16.65**
I liked this program.	3.28	3.28	.00	3.44	3.12	6.29*
I would like to do more math word problems like the ones in the program.	3.66	3.44	4.81*	3.68	3.43	6.26*
Overall means	3.52	3.31	10.83**	3.54	3.29	16.00**

*$p < .05$. **$p < .01$.

Teacher Attitudes

The overall mean teacher rating on the six items on the Teacher Survey was 3.71, a favorable rating indicating strong agreement with positive statements about the instructional program. All four respondents agreed very strongly ($\underline{M} = 4.00$) with three statements: "Personalization was a good teaching strategy", "I liked the personalized version of the program", and "I would enjoy teaching a personalized lesson to my students occasionally."

On the one open-ended question on the survey, "Please make any comments or suggestions that you would like to make about this instructional program," two teachers indicated that making math word problems more personalized increases students' motivation and interest. One teacher reported that the students would understand the personalized problems better because they could relate the information in the problems to their real-life situations and "shorten the distance" of their thinking patterns on the problems.

Discussion

The primary research question in this study addressed the issue of whether personalization of instruction increases the achievement of Taiwanese students on mathematics word problems. The treatment by test occasion interaction revealed that the personalized treatment did, in fact, result in significantly higher pretest-to-posttest gains than the non-personalized treatment. This positive finding for personalization of instruction is consistent with the results obtained in several studies of personalized mathematics instruction in the United States (Anand & Ross, 1987; Lopez & Sullivan, 1991, 1992). It differs from the overall result for personalization in the earlier study by Ku and Sullivan (2000) in Taiwan, in which a ceiling effect limited the potential gain of higher-ability fifth-graders.

The strategy of conducting this study with fourth-grade students, instead of fifth-graders as in the earlier study, had the desired result of reducing the strong ceiling effect observed previously (Ku & Sullivan, 2000). Despite the successful effort to reduce the ceiling effect with higher-ability students in this study, the significant ability level by test occasion interaction revealed that this effect was not completely eliminated. Higher-ability subjects averaged 95% (11.35 of 12 correct) on the posttest. This represented only 17% gain over their pretest score of 78%, but nevertheless approached the maximum possible score on the test. In contrast, lower-ability subjects were able to make a much higher gain, due in part to their much lower pretest score of only 31%.

The significant overall improvement from 55% on the pretest to 82% on the posttest indicated that the instructional program itself was generally effective across all treatment groups. This increase in scores occurred over an average time period of only about 53 minutes of instruction and review. In addition, the fact that students averaged 83% on the practice items and 82% on the posttest indicates that they retained their learning quite well from the instructional phase of the study to the final testing phase.

The finding that students scored higher on personalized test items than on non-personalized items, even prior to instruction (i.e., on the pretest), has potential implications for mathematics assessment. Certainly this finding merits further investigation in other settings and with larger samples to determine its consistency and generality. However, it suggests that students generally may score higher on math problems that include more familiar or personalized settings than on problems with unfamiliar or non-personalized settings. If that is the case, test developers who write standardized and criterion-referenced mathematics tests may want to consider the appropriateness of using settings for their problems that are generally familiar or popular with the projected test population.

The attitude data clearly indicated students' preference for personalized instruction, a result consistent with the findings in previous studies (Ku & Sullivan, 2000, Lopez & Sullivan, 1992, Ross & Anand, 1987). The strongest differences, all at the .001 level, were on items stating that the program was interesting; the program had many familiar persons, places, and things; and the program was easy. The first two of these statements reflect the intended nature of a personalized program and the third is consistent with the explanation that personalization may make learning easier by reducing subjects' cognitive load. Personalized subjects also agreed significantly more strongly ($\underline{p} < .05$) that they would like to do more math word problems like the ones in the program, a statement that suggests greater continuing motivation or willingness to return-to-task on their part. In general, the significant differences on these particular items support the claimed motivational and learning advantages of personalization.

Several significant differences between ability levels on the attitude survey also reflected differences that one might expect between higher-ability and lower-ability students. Higher-ability students agreed more strongly that they learned a lot from the program ($\underline{p} < .001$), that they were able to do two-step math problems well ($\underline{p} < .001$), and that the program was easy ($\underline{p} < .05$). These items appear to be the ones in the survey that were most closely associated with ability level. In contrast, higher-ability and lower-ability subjects did not differ significantly in their responses to items that logically seem to be less associated with ability.

This study was not designed as a test of theoretical explanations for the effects of personalization. However, certain data from the teacher and student surveys tend tosupport the "increased interest" and "reduced cognitive load" explanations described in the introduction section of this paper.

The present results were obtained using group personalization in a low-technology environment that is typical of the schools in Taiwan and in many other countries. A basic use of personalization, or interest-based instruction, in such settings is for teachers to make a conscious effort to learn their students' interests and to incorporate them regularly into their instruction. Teachers can supplement their existing knowledge of student interests by using an interest survey, as was done in the present study, and/or by holding occasional discussions with their students about current topics and events that may be popular with them.

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Transitioning Instruction From Face-to-Face To Distance Learning: Factors To Consider in Planning For The Migration

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Abstract

With the increasing use of web-based instruction in universities, faculty are being asked to transition courses from the classroom to the web. Migrating a course requires planning that includes changes in the instructional strategy and communications strategy that many faculty might not consider. This process is particularly challenging for instructors teaching their first online course. The contents of this paper grew out of an experience in transitioning a course from face-to-face delivery to web-based delivery. It represents challenges that emerged and offers recommendations for making the transition easier for faculty and students.

Introduction

With the explosion of web-based technology and the resultant increasing demand for web-based courses, many faculty members are faced with teaching their first online course. For these faculty, and others, the use of technology to deliver instruction can lead to course management issues that are unplanned for and result in challenges that are unexpected. Some of the challenges that have been reported in the literature are related to the need to change the approaches to instruction and interaction in order to make them more effective for the online environment (Pajo & Wallace, 2001; Boettcher & Conrad, 1999; Leh & Som, 1999). An additional challenge to transitioning is the time associated with using and monitoring the web-based environment (Pajo & Wallace, 2001; Daugherty & Funke, 1998). It is suggested that preplanning to augment a course to meet the requirements of the new delivery system might ease the transition for faculty. This paper presents factors that emerged from reflections from a transitioning experience. It recommends methods for making the transition easier for faculty.

The Experience

The insights and recommendations presented in this paper stem from an experience in teaching a course transitioned from face-to-face to the web. The course, Introduction to Instructional Systems Design (ci3.acns.fsu.edu/courses/EME 5603-01) was transitioned in the Fall Semester of 2000. This course is one of the corner stones of the Masters Degree program in Instructional Systems at Florida State University. The face-to-face course is well designed for an optimal student experience. It has been formatively evaluated and revised over many years. It is a product-based course that is structured to provide an intensive, highly individualized opportunity for students to develop, formatively evaluate, and revise their own instructional module. The web-based version of this course was designed to mirror the face-to-face class. All assignments were the same, the approach to the students was the same, and the products required were the same. The students were adult learners located in Virginia, Oklahoma, Georgia and Florida. Most of them work in corporate environments as trainers. Their final projects were of equal quality to the face-to-face class and the course was viewed as a valuable experience for both students and the instructor in terms of providing the flexibility of time to teach and learn and opportunities for high quality interaction.

While the course worked, the process created some potential threats to instructional effectiveness such as the additional instructional load. Factors that were major concerns in relation to the transition were: 1) translation of the from face-to-face directly to the web, 2) the highly individualized nature of the assignments and the resultant frequent formalized student-to-instructor interaction, without significant student-to-student interaction, and 3) the time management issues regarding managing and monitoring the course delivered via the web.

Factors to Consider

This experience suggested factors that faculty may consider in transitioning a course from face-to-face to the web. Such factors might be planning for the migration by 1) adapting the instructional strategy to change the course from teaching focused to learning focused, 2) developing a time management strategy for communicating effectively with students regarding issues of course content, course assignments, technical matters related to the course site, and sending and receiving assignments, and 3) obtaining support from the university for online facilitation. Recommendations are presented related to each of the three factors.

Recommendations

In terms of adapting the approach from teaching to learning, the instructor might reconfigure activities that work in the face-to-face classroom to achieve the desired learning outcome in a web-based environment. In adaptation for interaction in the web-based environment, the key in this adaptation is balanced interaction. Boettcher and Conrad suggest that student-to-student interaction should represent 40% of the total interaction in the course. The remaining 60% is divided between instructor-student and student-content interaction, with more focus on instructor-to-student interaction. Adapting the interaction to promote learning on the web, should increase student interest in the course and student satisfaction with the course (Leh and Som, 1999). In adapting the course, the instructor should consider using methods of synchronous and asynchronous interactions between student groups of various sizes. Synchronous interactions may include online chats or small group meetings and telephone calls. Asynchronous interactions may include online seminars, multimedia presentations, e-mail and discussion boards. The methods used will depend on the goals of the course, faculty choice of interaction method and student choice of interaction method (Boettcher & Conrad, 1999). Adapting the course to allow for more balance in the types of interaction should increase the effectiveness of a transitioned course in achieving learning outcomes.

Time management is a major issue for faculty transitioning a course from face-to-face to the web-based instruction. It is essential that faculty plan to structure their time to accommo date the needs of students at a distance. This involves planning to check daily for student emails, craft emails to respond to student emails, check discussion boards for student questions follow- up with students who fail to participate, address students needs for additional information regarding course content, address group issues dealing with technical questions about using the course site, and send and receive assignments. These aspects of teaching an online course may be familiar to online veterans and many of these issues may translate readily from the classroom to the web. However, for the novice, the distance sometimes complicates completion of simple tasks. For example, communication that might take place at the end of class or in the office may take much longer to complete effectively online. Technical issues related to using the course delivery system may compete for faculty attention in teaching the course. Additionally, sending and receiving assignments may be complicated by the technology. In sum, a course taught at a distance may require more of the instructor's time than a face-to-face course. Faculty and administrators should be aware of this when considering assigning duties and responsibilities that involve a transition of this kind.

Planning to address course management issues can be alleviated through additional support from the university. The addition of a mentor/facilitator would assist in changing the focus of the instruction from teaching to learning (Moore & Kearsley, 1996). This facilitator could assist in addressing many of the course management issues that affect instructor time. He/she could also help in creating the learning environment, facilitating communication to ensure a smooth student experience in the course by responding to emails, checking discussion boards and solving technical problems. This would free the instructor's time to focus on more substantive issues related to achieving learning outcomes. This kind of support would appear to ease the transition from face-to-face to the web.

Conclusion

In conclusion, the growth in the use of the web for delivery of instruction has led universities to increase expectations that faculty will transition courses from face-to-face delivery to web-based delivery. To facilitate effective transition, faculty should plan to address course management issues by: 1) adapting their courses from a teaching to a learning focus, 2) structuring their time to accommodate the additional demands of teaching an online course, and 3) obtaining additional support from the university to facilitate the learning environment. These recommendations address issues that may assist faculty in planning to transfer a course from the classroom to the web. The discussion of the impact of transitioning on faculty will surely continue as demands for web-based course offerings increase and more faculty respond by transitioning courses to web-based delivery.

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Brownfield Action: An Integrated Environmental Science Simulation Experience for Undergraduates

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Objectives

The purpose of this paper is to present the results of three years of development and evaluation of a cd-rom/web hybrid simulation known as Brownfield Action for an introductory environmental science course at an independent college for women located in a large city in the northeastern USA.

Perspectives

Science courses often struggle to link the material in lecture and laboratory for many reasons. Laboratories are often taught by different personnel, and must fit into constraints of equipment and time, as well as safety and level of difficulty. A large survey course may cover dozens of topics, whereas a student typically experiences no more than fifteen laboratory periods in a given semester. Larger than these logistical issues is the student's mindset in each environment. Life science lectures require rapid note taking and passive concentration as verbal information is drilled at students for anywhere from one to two hours. Laboratory sessions typically require two to three hours of recipe-following and occasional problem solving. These two functions operate in isolation because there is little time in lecture to discuss experimental technique (if the lecturer even knows that information) and a laboratory is not typically set up for someone to give verbal instruction as occurs in the lecture hall. But more than these aspects, typical science students spend most of their time memorizing verbal information for lecture exams, and memorizing techniques, anatomy, and taxonomies for laboratory practical examinations. Rarely is information from one used in the other simply because the lecture focuses on concepts while the laboratory teaches technique. Students often walk away from a course feeling as if it were two courses and fail to get a sense of the content as a whole.

Simulations provide the ability to integrate content into a complex problem that students can explore. The closest work to the experience of the Brownfield Action design and development process can be seen in Goodrum, Dorsey, and Schwen's work on defining and designing Enriched Learning and Information Environments (ELIEs) (*Educational Technology* November 1993). In this paper, the researchers describe how their experience with designing educational environments led them away from entirely technology-based and theory-based definitions and more towards what they define as a socio-technical definition that focuses on the people involved and the specific work they are asked to perform. They perceive that the latest learning theory and the latest technology does not lead to innovation, but instead that all innovations are situated within a context of people trying to accomplish work in a particular environment, and a well-designed teaching and learning tool should support that work. They go on to describe their design work as a series of relationship building with users, rapid prototyping with mock-ups and a focus on the tasks that users needed to perform. The Brownfield Action project follows a similar model.

Methods

Columbia University's Center for New Media Teaching & Learning (CCNMTL) developed and implemented a cd rom/web hybrid simulation known as Brownfield Action in the Fall of 1999 and again in the Fall of 2000 at an independent college for women located in a large city in the northeastern USA, which models how an undergraduate Environmental Science course can directly integrate its lecture and laboratory components. Through presenting students with a complex problem that requires the application of knowledge and skills learned in lecture and in the laboratory setting, performance and engagement is improved, and students experience environmental science as a highly integrated field while developing real-world problem solving skills. Rather than reserving higher level thinking skills such as analysis and synthesis for smaller, more advanced courses, Brownfield Action allows introductory students to see environmental science as an integrated and dynamic part of society, rather than a series of abstract concepts and recipe-driven techniques.

Brownfield Action is a simulation that provides a learning environment for developing the skills of an environmental site investigator by placing students in a virtual town and asking them to serve as consultants to a real estate developer who wants to avoid purchasing potentially contaminated land. Students must become actively involved in the lecture and laboratory in order to succeed. They must learn to explore and discover a path to a solution to the problems they encounter and work collaboratively with a partner in order to reach a valid conclusion.

Pairs of students form environmental consulting companies to investigate a hypothetical abandoned factory site in a small town. A mall developer who wishes to purchase the factory site contracts with each two-student company to conduct an investigation, write a report recommending a course of action, and construct maps of the site's basic geology, topography, and any contamination they discover.

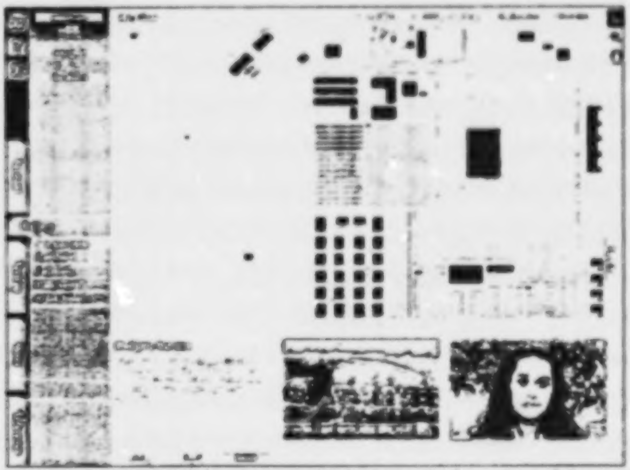

Figure 1. A screen capture of the site map in the historical section of the application.
The user is preparing to interview the owner of the local nursery in the town.

To complete the maps and report, students must first gather a site history from the town's resources. Through the simulation, students visit government offices, businesses, and residences to conduct interviews with town's officials and citizens and to obtain public documents (Figures 1 and 2).

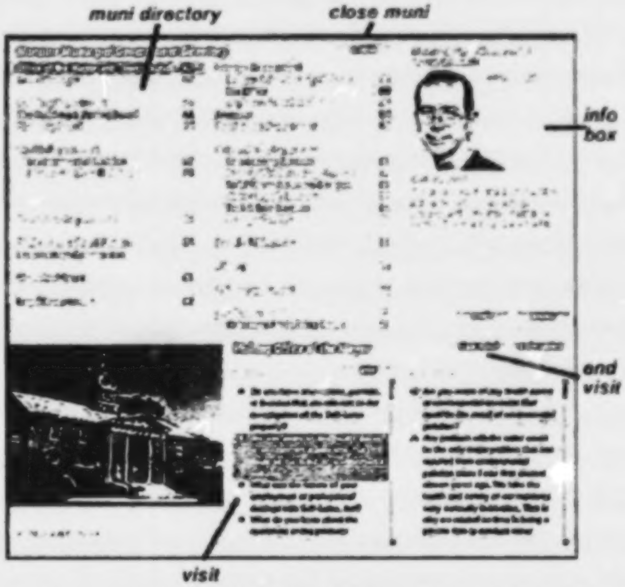

Figure 2. A screen capture of the municipal directory where students visit government offices.
The user is interviewing the township mayor.

Using the information obtained from the town's history, students then conduct a series of environmental tests to determine the presence, extent, and probable cause of any contamination. Some tests, such as soil permeability, are conducted as traditional laboratory exercises placed within the context of the simulation. Other tests, such as well monitoring, are conducted virtually using the computer. Over two million data points are available for collection over the 64,000 square foot virtual site map, including bedrock and water table data as well as contamination concentrations at depths of over 150ft. This vast quantity of data, both through the site history and the environmental testing, allows for an infinite number of strategies for testing and a unique data set for every student company. Successful students work within the given operating budget and clearly identify the cause and extent of the contaminated areas on the site.

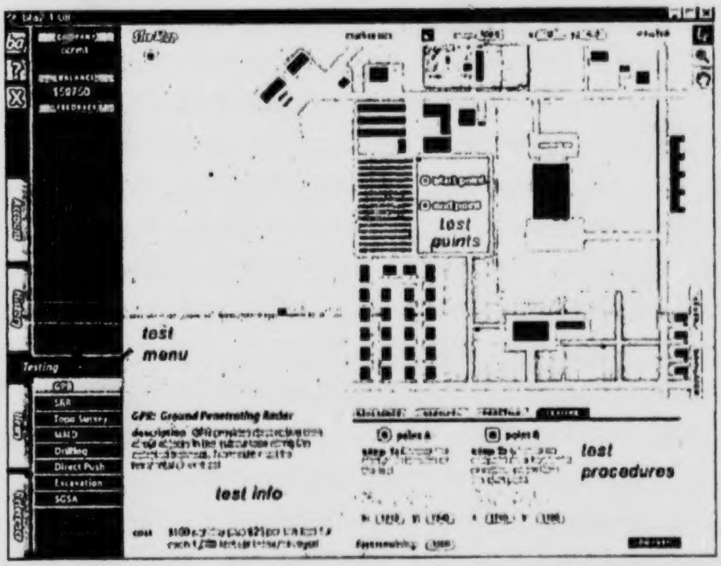

Figure 3. A screen capture of the testing interface.
The user is preparing to use the Ground Penetrating Radar test on the Site Map.

Brownfield Action is not intended as a cost-cutting measure, a time-saver, or a replacement for other material, but as a method of integrating what was formerly disparate labs and lectures into a seamless learning experience that improves student learning and motivates students to critically consider the importance of all the issues involved in the system of human impact on the environment.

The primary faculty member, serving also as the subject matter expert, identified the following objectives:

After experiencing Brownfield Action, students will be able to explain how to approach and solve a scientific problem by:

- describing the strategy used to discover contamination sites in Brownfield Action;
- identifying and explaining the outcomes of environmental tests they conduct and related information, making recommendations and being aware of the consequences of their decisions;
- drawing inferences from data about structures that contribute to environmental contamination;

and students will:

- read articles on ecology with different understanding, interest, and personal commitment;
- appreciate that real world decision-making about ecology involves ambiguity rather than certainty.

To assess the effectiveness of the second version of Brownfield Action (BfA2.0) that ran in the Fall of 2000 in meeting its objectives, students were surveyed at the beginning of the simulation to obtain an indication of their perceptions of the levels of knowledge and skill targeted by the course with which they started. The laboratory directors prepared a daily implementation log providing detailed documentation of the BfA2.0 experience in the labs. The evaluators observed five lectures and six of the three-hour labs to further their understanding of the instructional setting within which the Brownfield Action simulation was conducted. At the end of the course, students rated Brownfield Action on how well it had contributed to the objectives of the course and other matters,

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and all students participated in hour-long focus groups to provide in-depth responses to questions not amenable to discovery through written survey questionnaire. The evaluators also conducted hour-long, post-course interviews with the lead designer of the simulation; the primary faculty member (subject matter expert), and the laboratory directors. Finally, a cross section of the papers prepared by BfA2.0 students was reviewed and compared with student papers from previous years.

Data Sources

The entire course of one hundred and twelve female students were surveyed using two questionnaires (one at the beginning of the semester, one at the end) and a series of focus groups at the end of the term (one for each of the eight lab sections).

In the survey questionnaire and focus groups we investigated students'

- perceptions of pre- and post-test levels of their knowledge;
- perceptions of the success of BfA2.0 in meeting its objectives;
- perceptions of the contributions of various components of BfA in assisting them to solve the overall problem addressed by BfA2.0, and how well BfA2.0, the lectures and the lab succeeded in directing them to focus on the major problem addressed by BfA2.0.
- overall evaluation of BfA2.0, positive and less positive;
- recommendations for technical improvements in BfA2.0;
- perceptions of the most valuable parts of BfA2.0;
- perceptions of what could be done to improve BfA2.0.

The evaluation team also examined students' final reports in accordance with the learning objectives outlined by the primary faculty member as well as the daily laboratory implementation log prepared by the laboratory directors.

Summary of Results

- Students learned more and in greater depth using Brownfield Action than in previous years without it.
- Student work looked more authentic and professional, closer to what would be expected of a professional performing these tasks.
- Students appreciated how the simulation contributed to their understanding of the material.
- Brownfield Action was successful in (1) enhancing the scientific literacy of students, (2) facilitating their construction of new meaning based upon what they saw and experienced and (3) enhancing practices leading to increased student learning.
- Students' abilities to construct new meaning based upon what they saw and experienced were expanded.
- Students found the content useful and the simulation a good way to learn it.
- More staff development is necessary to foster the teaching strategies needed for a true discovery process and to build comfort with technology.
- Minor technical glitches created levels of frustration that interfered with its ability to meet its educational potential. These glitches notwithstanding, the students gave high ratings to other features of the technology. In particular, eight out of ten students noted the ease with which it was possible to move through information in each of the sections of the simulation.

Discussion

The simulation in the context of Brownfield Action is not just in the technology, but in the classroom environment set up around and supported by the technology. The simulation is in the course curriculum, the faculty member, the lab directors, and the students, and it only becomes a simulation once all of these factors work in parallel. For as long as there has been computing, many have tried to *simulate* aspects of reality with computing power, but the reality is that all that has been built to date might be better called *simulators*. Simulators model real-world processes with mathematical equations and variables that can be manipulated so that changes can be observed and analyzed. The software for Brownfield is no different upon close inspection. It is a model of a town with a mathematically driven contamination event that occurs within a narrative, but the narrative does not exist without the students fulfilling their role as investigators. In other words, the story does not get carried out unless the students and faculty pursue their roles and fulfill their tasks, or in effect, write their parts of the story as they interact with the simulator. Brownfield Action could be run in a classroom without any technology at all, and in fact it was done on a smaller scale for many years using an elaborate note card scheme. The computer software supports the expansion of the simulation created in the classroom, giving it a visual space, a more efficient process for collecting data, a means for communication, and more definition and depth (literally and figuratively) to the environment that is to be examined. The software itself does not teach. Instead it invites the user to engage in the problem. To foster engagement, one needs motivation and a safe space to take risks, and that is where the surround, the classroom, the curriculum, and the instructors come in to play.

Simulations can be powerful teaching and learning environments because operating in the real world is not really all that different from participating in a simulation. Everyone has roles to play in the real world (probably more than one), and there are problems, conflicts, and obstacles to be encountered and overcome in each of those roles. The method for overcoming these problems is in communication and experimentation, which includes hypothesizing, collecting data, analyzing, synthesizing, and applying previous discoveries with other role players using the tools that are available. One of the tools available in Brownfield Action is the software, but there are also physical maps, soil samples, reference material, and other similar narratives such as *A Civil Action*, a novel all students in the course read. Most any profession is going to place people in a similarsituation and demand the same action from its participants. Brownfield Action provides a safe environment, away from the consequences of the real world – the money involved isn't real, one's job isn't at stake, etc… - so students can essentially practice living in the real world by immersing themselves in the problem to be solved in the simulation.

As outlined in studies such as Sandholtz's *Teaching with Technology: Creating Student-Centered Classrooms*, instructors need to phase out traditional directed or didactic teaching techniques and work towards more guiding and exploring strategies for teaching with technology to be most effective. This has proved true with Brownfield Action as well, so in preparation for this year's course, we instituted more staff development for the laboratory directors to assist them in improving their instructional techniques as well as a study guide to aid students in orienting themselves to the project.

All known technical glitches from last year's experience have been remedied for this year's course, but minor problems may continue to appear as they would with any project of this magnitude. Over time the instructors and support staff will only get more accustomed to the common problems students experience, so the effects of these problems should be minimal.

All in all, the project has proved successful in providing students with a more integrated science experience than in traditional classrooms and CCNMTL (http://ccnmtl.columbia.edu) looks forward to developing more simulation models for teaching and learning based on this project.

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Pre-Kindergarten through Grade Twelve Web-based Science Course of Study

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This rapid prototype web-based Pre-Kindergarten through Grade Twelve Science Course of Study is being developed by teachers for student and is based on state standards. It is organized by strand and grade level using benchmark state proficiency outcomes and competencies as framework. Best practice activities, assessments, and resources are correlated to student outcomes. Since the Ohio Department of Education is in transition from the current instructional model to academic content standards, this course of study is an ongoing endeavor that will be revised and updated to reflect current best practice based on student results as new assessments and diagnostic tools are developed.

Design

Needs Assessment

During the spring of 1999, two science consultants from the Mid-Ohio Educational Service Center (MOESC) surveyed science teachers and administrators in the eighteen school districts within the tri-county service area to determine their needs for the upcoming science course of study. Respondents to the survey indicated the following design criteria: web-based, interactive, a dynamic document, functional, user friendly, and resource rich. (MOESC, 1999)

Rapid Prototype Instructional Design Model

Initial design was determined by a committee consisting of teachers from all participating districts and a team of science consultants from the educational service center. A three-year design, development, and implementation process had been planned prior to the recruitment of the teacher team. The print version was to be completed by August 2000 for delivery to teachers that fall. Since the timeline was short, a rapid prototype needed to be developed. Jones and Richey (2000) state that rapid prototyping methodology "encourages communication between everyone concerned with the effort. Subject matter experts assist in content identification throughout the project. End-users react to the prototype to provide feedback regarding the design, instructional activities, and user interface." This should satisfy customers, in this case, science teachers, "because they are involved in an extensive formative evaluation of the actual product throughout its design and development."

Feedback during this phase of development was provided through a listserve as the components were loaded to the web. "Prototyping is defined by Tessmer (1993) as a hybrid of formative evaluation and design activities." (Seels & Glasgow, 1999, p. 150) Seels and Glasgow provide two reasons for developing a prototype.

> First, the designer may have questions about the student's ability to learn from and use the new system. Secondly, when a new technology is involved there may be questions about the design team's experience with new ways of doing things. Prototype development allows the client to assess the cost effectiveness of the new system and allows the design team the opportunity to learn new skills in an environment where the consequences are less expensive. (p. 151)

A web site was devoted strictly to the design phase of the course of study. E-mail addresses of team members were compiled and notice of the addition of new components was immediately sent to the committee for their review and subsequent formative evaluation of the component being appraised. Changes or improvements were made by posting any suggestions, waiting for responses, and subsequently making the adjustments.

Organization of the Course of Study

The Table of Contents was the initial component to be created, since the *Ohio Model Competency-Based Science Program* provided a diagram "to communicate the structure and relationship of components of a local science curriculum...." (Ohio Department of Education [ODE], 1994, p. 8) Each component added was linked to the text descriptors in the Table of Contents. Links to the *National Science Education Standards* and the *Benchmarks* *for Science Literacy* were created early in the process to provide the committee with research based reference material on which to formulate decisions regarding the components to be created thereafter. A few teachers who devoted extra time to the creation of the Ohio Model science curriculum components earned university credit. These were e-mailed to the designer, converted to web pages, and loaded to the web site for review by the remainder of the committee.

Grade Level Templates

The most crucial and problematic design issue proved to be the grade level templates. Student performance data for the science portion of the Ohio Proficiency Tests are reported according to seven categories as defined by the *Ohio Model Competency-Based Science Program.* Proficiency test learning outcomes "are grouped into four strands - Nature of Science, Physical Science, Earth and Space Science and Life Science." (ODE, 1994, p. 117) and three Performance Objective Levels of Understanding: "Acquiring Scientific Knowledge – observing, collecting, and recording data and information from various sources; Processing Scientific Knowledge – organizing, interpreting, manipulating, and reformulating observations and data;" and "Extending Scientific Knowledge – applying, formulating, transforming, and communicating ideas in a variety of contexts." (ODE, 1994, p.111) The difficulty with this, however, is that the Ohio Model is organized into the following four instructional strands: Scientific Inquiry, Scientific Knowledge, Conditions for Learning Science, and Applications for Science Learning. (ODE, 1994, pp. 19-22) and performance objectives that "have been constructed by considering the instructional objectives from all four instructional strands...." (ODE, 1994, p.23) "School science committees should use their grade-level instructional objectives and the examples of performance objectives in the model to create district performance objectives for the local science curriculum." (ODE, 1994, p. 17)

Arriving at the Framework

Since proficiency results are made public, it is by those criteria that effectiveness of science programs is demonstrated. In order to improve student performance, the templates were designed by proficiency outcome by strand and grade level. Icons were chosen to represent the strands of the learning outcomes.

Work had been done at an educational service center in the southeastern part of Ohio, Muskingum Valley Educational Service Center, to further clarify the meaning of the proficiency outcomes for teachers. (Muskingum Valley Educational Service Center, 1999) Their teacher inventories were adapted to frame the assessments and suggested activities and resources for the grade level templates. There was a meeting of the full committee and the template was accepted as the framework.

Development

Summer Session

The development team attended a three-day summer session to research and add resources to the templates. Participants were provided with various forms of instructional materials, such as textbooks, literature, kits, periodicals, and electronic resources and received instruction on proper citation of materials and editing of web pages. The remainder of the time was spent incorporating the materials into the templates.

Board Adoption

The Governing Board of the Mid-Ohio Educational Service Center approved the Science Course of Study on July 24, 2000. In early August at an administrative retreat, the course of study was introduced and the print version was distributed to central office personnel. In early fall, a rollout of the course of study was held in each county in the service area and a print version customized to the grade level of the teachers was distributed. Teachers received their grade level and the one immediately preceding and following, along with the Table of Contents and other key components.

Additional Formative Evaluation

Districts began curriculum alignment at their own pace throughout the first semester of the 2000-2001 school year. At a high school principal's meeting in early winter where the course of study was being discussed, principals expressed dissatisfaction with the initial design of the grades nine through twelve portion of the course of study. The template approach was not feasible with the discrete course offerings. Smith and Ragan (1999) have cited Tripp and Bichelmeyer, representing the idea that "the analysis of needs and content depends in part on the knowledge that is gained by actually building and using a prototype instructional system." (p. 376) This negative feedback was entirely unexpected by the designer, who sought to find a solution that would satisfy the administrators and still serve the needs of the teachers who would ultimately be the end users.

Curriculum guides were submitted from all participating districts and templates for subject area courses were created based on the course descriptions. Pre-kindergarten through grade six teachers attended a seminar series: "Learn How to Use the New Science Course of Study," "Science Resource Vendor Fair and Children's Literature," and "Planning Your Science Instruction for 2001-2002." Grades seven through twelve teachers received orientation to the templates for the subject area courses. The nine through twelve course templates were further developed, including the addition of subcomponents to the topic areas of each discrete course. The existing web version was edited and teachers added the course requirements of each district and subsequently added resources to the developing courses. Additional resources were also added to the grades seven and eight courses.

Implementation

Average Proficiency Test Performance

Proficiency test results for the past three years on grades four and six proficiency tests were averaged for all districts. Over thirty percent of the students demonstrated average performance lower than the minimally proficient standard for the following science strands on the Fourth Grade Proficiency Test: Nature of Science, Physical Science, Earth & Space Science, Level of Understanding: Acquiring Knowledge, Level of Understanding: Processing Knowledge, and Level of Understanding: Extending Knowledge. An equal percentage demonstrated lower than the minimally proficient standard for the following mathematics strands on the Fourth Grade Proficiency Test: Numbers and Number Relations, Level of Understanding: Conceptual Understanding and Level of Understanding: Application & Problem Solving. Over thirty percent of the students demonstrated average performance lower than the minimally proficient standard for the following science strands on the Sixth Grade Proficiency Test: Nature of Science, Physical Science, Earth & Space Science, Life Science, Level of Understanding: Acquiring Knowledge, Level of Understanding: Processing Knowledge, and Level of Understanding: Extending Knowledge. An equal percentage demonstrated lower than the minimally proficient standard for the following mathematics strands on the Sixth Grade Proficiency Test: Problem Solving Strategies, Numbers and Number Relations, Geometry, Algebra, Estimation and Mental Computation, Data Analysis and Probability, Level of Understanding: Conceptual Understanding, Level of Understanding: Knowledge & Skills, and Level of Understanding: Application & Problem Solving. (MOESC, 2001)

Professional Development Needs Assessment

In order to determine the professional development needs of the science and mathematics teachers in the participating districts, a Science and Mathematics Needs Assessment Survey was completed by 581mathematics and science teachers in seventeen of the eighteen participating school districts. Four districts were chosen by the Mid-Ohio superintendent to participate in a Science and Mathematics Needs Assessment Interview to obtain more additional qualitative data. (MOESC, 2001) All administrators and central office personnel and twelve teachers per district, one from each grade level, were asked what they saw as the most immediate mathematics and science curriculum need in their district and why and what types of professional development they thought would address that need. They were also asked about possible content area activities and they types of resources that would help provide better mathematics and science instruction in their district.

The survey and interview data indicate that the following professional development opportunities are needed: searching techniques, integrating technology into the curriculum, alternative assessment, assessing the needs of the learners, analyzing proficiency data, curriculum alignment, and adaptations for special needs. The majority of teachers prefer that the sessions are two hours or one half day in length, either during early release or during the school day with a substitute. Most teachers would like to have work sessions with teachers at their own grade level or those just above or just below. The greatest majority expressed preference for meetings at the building level, followed by the district level. Stipends were the preferred type of compensation.

Ongoing Improvements

Ohio is in transition from the current model to Academic Content Standards. The State Board of Education is scheduled to adopt the new standards in December 2002. (ODE, 2001) The new state curriculum model is due eighteen months later. The standards framework consists of Academic Content Standards, which the Ohio Department of Education defines as "What all students should know and be able to do; the overarching goals & themes." Benchmarks are defined as "key checkpoints that monitor progress toward academic content standards." Benchmarks are "identified by grade-level clusters/bands," i.e., K-3, 4-5, 6-8, 9-12, that "will vary across content areas and align with achievement tests where applicable." The Grade-Level Indicators provide "what all students should know and be able to do at each grade level" and can be used as checkpoints to "monitor progress toward the benchmarks." (ODE, 2001)

Conclusion

This Course of Study has served as the model for the Social Studies Course of Study currently in the implementation stage and the Mathematics Course of Study beginning this year. Due to the experience gained with the Science Course of Study, the three-year process to implementation has been narrowed to two years for the Social Studies and Mathematics Courses of Study and all of those to follow.

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Students' Experiences of the Implementation of an Interactive Learning System in their Eighth Grade Mathematics Classes: An Exploratory Study

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Abstract

During the last decade US K-12 schools have approximately tripled their spending on increasingly powerful computers, expanded network access, and novel computer applications. The number of questions being asked by educators, policymakers, and the general public about the extent to which students are using these educational technologies, for what purposes, and to what effects, has likewise increased. Exploring the human implementation process is thought to be one key to understanding how educational technologies find, purchase and evolve in local classroom environments. This naturalistic inquiry explored students' classroom experiences during the semester-long process of implementing an interactive learning system, Destination Math, in two eighth-grade math classes in a rural mid-Atlantic Junior–Senior High School. Data collection was based on field observations prior to and during the implementation process, semi-structured interviews and focus group interviews with students, and document analysis. Grounded theory methods were used to analyze the data. I found that students experienced high levels of learner-control when using the interactive learning system for math, given the variety of activity choices afforded by the instructional medium, the multiple pathways to representation of math concepts, and the opportunities for math-talk with their peers. For these three reasons, students reported increased interest in math in the Destination Math class, compared with the regular math class. Researcher observations supported students' self-reports: students' engagement with math, operationally defined as time-on-task, increased in the Destination Math class. These findings suggest that when educational technologies are used to heighten student-control over the learning environment, these instructional tools may increase students' interest in subject matter and their engagement in learning.

Introduction

Increasingly powerful computers, expanded network access, and novel computer applications have enlarged both investments in, and expectations for, the transformation of students' classroom learning experiences. During the last decade US K-12 schools have approximately tripled their spending on educational technologies (Quality Education Data [QED], 1999). Improving students' classroom learning experiences by exploiting the appeal of challenging interactive learning technologies is a powerful motivation for such significant investments in educational technologies. However, while investments in educational technologies have steadily increased, not enough money has been spent on educational research (Web Based Education Commission, 2000; Shaw, 2000). Merely because curriculum producers are making software and their school customers are acquiring their products and the hardware to allow them to be used, does not tell us how, or to what extent, the daily lives of typical school children are being affected or changed by these educational technologies (Becker, 1998, p. 20). The present research was designed to enliven and enlighten current discussion of student-use of educational technologies in classrooms, by exploring the implementation of an educational technology in two eighth grade math classes.

This research represents a departure from the early research on educational technologies (1970s and 1980s) which emphasized the learning outcomes value-added model: the decontextualized, cognitive-psych pedigree of researching individual students' interactions with computers. These early studies looked so specifically at particular technologies and their impact on single students, that they contributed little to the larger more challenging project of understanding the roles that technologies can play in addressing the key challenges of learning in classroom contexts. Recent research on educational technologies is characterized by an awareness that the impact of technology on specific aspects of teaching and learning can be "usefully understood only in context" (McMillan Culp, Hawkins, and Honey, 1999, p. 8). Educational technologies alone do not translate into improved instructional outcomes: they matter only when harnessed for particular ends in the social context of classrooms: they must therefore be studied in these contexts. The regular math class, and the DM class, represented the contexts for this naturalistic inquiry. Throughout this fourteen-week study, the focus of the research was on the students' experiences with the interactive learning system in their math class.

Research on classroom innovation has infrequently focused on students' experiences of changes in their classroom learning environments (Hammersley, 1999). While previous research has identified student attitude toward educational technologies as an important variable influencing their learning experiences (Francis & Evans, 1995; Liu, 1999; Christensen, 1997), these studies have not described students' experiences with these novel tools over time and in students' own words. Instead, students' reports of their classroom experiences with educational technologies have focused on the frequency of computer use in specific courses, the type of software utilized, and students' responses to an admittedly rough categorization of activities (Becker, 1994). The purpose of this study was to describe students' experiences with an interactive learning system during one school semester. The main research question asked: How do students experience a classroom innovation in the form of an interactive learning system in their math class, during the semester-long implementation process? This question was operationalized by asking the more informal question: What do students do, say and make in the research context over time?

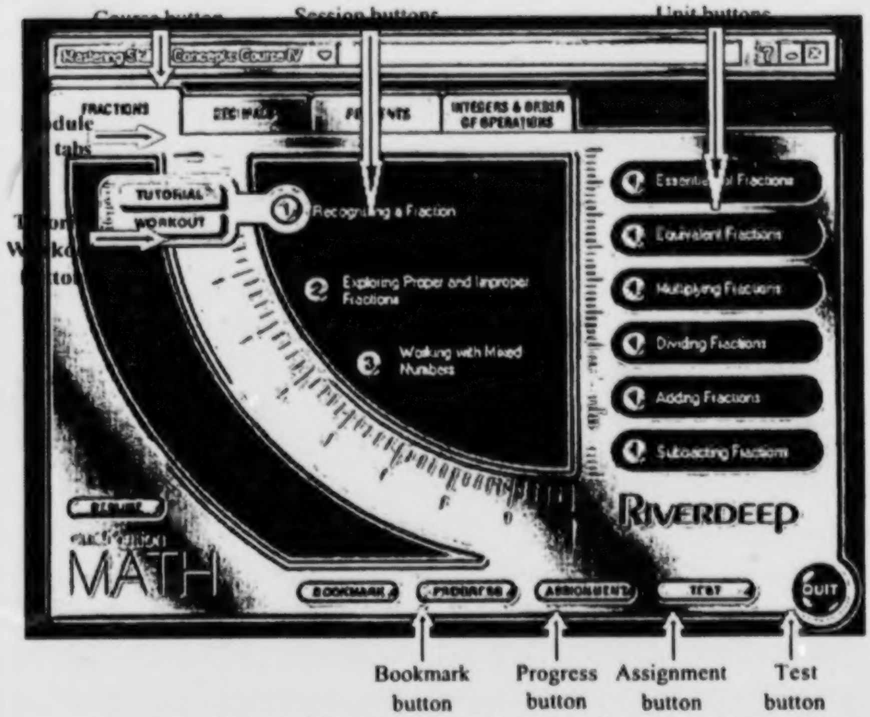
Research Context

Participants

Participants in this study included 32 students (14 and 18) in two lower-level eighth grade math classes. This research began in the regular math class four weeks prior to the implementation of the interactive learning system, and continued during the ten-week implementation process. Qualitative methods were used to explore the process of implementing the interactive learning system, DM, twice weekly, during students' regularly scheduled (40 minute) math period in the computer lab, on Wednesdays and on Thursdays. On alternate days, students and their teacher used the "highly structured" and "highly prescriptive" (Saxon, 2001) text -based math lessons, provided in the district-adopted math curriculum. In this study, the teacher used the Riverdeep (RVDP) Interactive Learning System to revise math concepts previously taught to students using the Saxon math lessons.

Materials

RVDP was founded in Ireland in December 1995 as a developer and provider of technology-based educational solutions for the United States kindergarten through high school, or K-12 market. RVDP offers Internet and CD-ROM based comprehensive courseware and supplemental curricula in math, science, and language arts.
Figure 1. DM Main Menu Screen (Course IV)


Course button
Session buttons
Unit buttons
Mastering SK
Concepts Course IV
FRACTIONS
DECIMALS
PERCENTS
INTEGERS & ORDER OF OPERATIONS
Module tabs
TUTORIAL
WORKOUT
Tutorial Workout buttons
Recognizing a Fraction
Exploring Proper and Improper Fractions
Working with Mixed Numbers
Essential Fractions
Equivalent Fractions
Multiplying Fractions
Dividing Fractions
Adding Fractions
Subtracting Fractions
RIVERDEEP
MATH
BOOKMARK
PROGRESS
ASSIGNMENTS
TEST
QUIT
Bookmark button
Progress button
Assignment button
Test button

In November 2000, the Westridge school district purchased licenses for use of the Riverdeep interactive learning products by all eighth grade students and their teachers, intentionally targeting improvement of students' math skills. RVDP curriculum products for middle school math include *Destination Math* (DM), a comprehensive math program designed to supplement or replace traditional math curricula, and *Tangible Math* ™, a simulation-based math program, which focuses on the development of students' problem solving and analytical skills. In the present study, the teacher chose to implement the DM component of the RVDP suite of learning resources with both her eighth grade math classes. DM comprises five math courses organized in two series or curricula for students in grades four to twelve. Participants in this study used DM Course IV Mastering Skills and Concepts.

Figure 1 presents the structure of DM Course IV, used by students in this study. The course is composed of four *modules*: Fractions, Decimals, Percents, and Integers and Order of Operations, each representing a major topic in the eighth grade math curriculum. Each DM module is further broken down into *units*, which address specific learning objectives and are correlated with state and national standards for mathematics learning. The teacher management system for DM contains a bank of test items that are correlated with specific learning objectives, and organized by unit. Unit buttons for the fractions module are visible to the right of the user's screen in Figure 1. DM units are further divided into three *sessions*. The user enters DM at the session level.

Each DM session comprises a *tutorial* and a *workout*. The user may also access a tutorial or workout as a system-generated *prescribed assignment*, based on the level of mastery of learning objectives demonstrated by the user on assigned tests. From the main menu, DM users may choose to work on a teacher-assigned test, a tutorial, or a workout. During their ten-week use of DM in their math classes at Westridge, students were instructed to complete teacher-assigned DM tests, prescribed assignments, and any additional activities for each unit, before proceeding to the next unit.

Data Collection

Participant observation strategies (observation and conversation) enabled me to take an active role in experiencing and enquiring about (Wolcott, 1999) students' uses of DM in their math classes. In the initial weeks of this study, I focused my classroom observations by detailing elements of the classroom environment (classroom map

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protocol), and describing the activities of students therein (activity framework protocol). I recorded students' actions and interactions within the DM math class using a small pocket recorder. Written descriptions of participants' coverbal behaviors (expressions, gestures, actions) in their math classes informed and extended students' voice-recorded data. Combined with classroom observations, unscheduled verbal exchanges with students provided valuable opportunities for me to become familiar with "the native communicative repertoire" of participants in the eighth grade math class (Briggs, 1984, p. 24). These classroom conversations provided crucial information on the interaction between the eighth grade students' use of language, and their social behavior, and also between students' social and cultural norms and patterns of interaction in the math class. Ongoing conversations with students informed the development of semi-structured interview guides throughout the data collection process.

I planned exploratory and culminating focus group interviews with students to further explore their experiences with educational technologies and math in general, and with DM in particular. Flick (1998) suggested four processes or elements of group discussions, which I used to structure the focus group interview guide: brief explanation of the research procedure, preparation for the discussion, discussion stimulus, and process discussion (p. 119-120). I held exploratory focus group interviews with students to probe their prior experiences with educational technologies at home and in school, their attitudes toward math, and their expectations for the DM learning system. Culminating focus group sessions in the final week of this research offered opportunities for respondent validation or member checking of my own interpretations of students' experiences with DM in their math class.

I used Patton's (1990) "general interview guide approach" (p. 280) to plan periodic semi-structured interviews with individual students. These interview guides were developed and sequenced using Spradley's (1979) ethnographic questions, the third element in his ethnographic interview (p. 58-68). I used naturalistic sampling (Ball, 1990) to select four students for semi-structured interviews "to generate the information upon which the emergent design and grounded theory can be based" (Lincoln and Guba, 1985, p. 201). Combined with classroom conversations and observations, these individual interviews enabled me to construct portraits (Lawrence-Lightfoot and Hoffman, 1997) or mini-embedded case studies of four students in the teacher's eighth grade math classes (two students from each class). Each individual student portrait served as a rhetorical device, providing vivid renditions of broadly observable patterns of class behavior, thereby directing and redirecting the most fruitful path of research in answering the research questions. These four richly detailed student portraits, grounded in conversation and interview data, facilitated "the on-going joint collection and analysis of data associated with the generation of theory" (Glaser and Strauss, 1967, p. 48).

To further extend my understanding of the research context, I analyzed text documents gathered from the research setting (Glesne and Peshkin, 1992) which included a printed copy of the school mission, the Saxon math texts, students' homework assignments, DM test reports, DM progress reports, and so forth.

Data Analysis

Given the documented need for new, theoretically expressed understandings of students' and teachers' experiences of the classroom implementation of educational technologies, I chose to analyze my transcribed research data (classroom observations, classroom conversations, interviews) and related documents, using grounded theory methods. "The value of the methodology… lies in its ability not only to generate theory but also to ground that theory in data" (Strauss and Corbin, 1998, p. 8). I proceeded from description to conceptual ordering and theorizing (three activities foundational to Strauss and Corbin's theory building process), by iteratively coding transcribed data regarding students' activities in their math class. Strauss and Corbin (1990) explained that coding is "the process of analyzing data" (1990, p. 61), in order to create theory from data.

I developed a systematic three-step process for coding all transcribed data. To generate initial categories and to discover relationships between these categories, I began by coding transcribed exploratory interviews and classroom conversations by hand, using participants' own words (in vivo codes) when possible. I then record coded data electronically using the qualitative data analysis software, *N.5*. In parallel with my use of N.5 to code transcribed data (line-by-line and open coding), I employed the concept-mapping software program, ***Inspiration***, to explore relationships within and between concepts evident in the data (axial coding). The multiple representational methods for linking categories, which Inspiration afforded, supported development and refinement of my emerging grounded theory (selective and focused coding) of students' experiences with DM in their math class.

Flick (1998) noted that this combination of multiple methodological practices in a single study is best understood as "a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry" (p. 231). I employed these methods of data collection and analysis to secure an in-depth and richly-triangulated understanding of students' experiences with an interactive learning system in their math class. Maxwell's (1992) five kinds of understanding and validity in qualitative research (descriptive, interpretive, theoretical, generalizability and evaluative) were used to guide all phases of data collection and data analysis.

Results and Discussion

During the ten-week implementation of DM in their math class, students experienced a level of control over their own learning that they had not experienced in their regular math class using Saxon. Control is relative. Students spoke positively about the level of control afforded to them vis-à-vis math activities, representation of math content and the social context for these activities: the opportunity to interact with their peers, in the DM math class.

Activity Choices

Students who completed their DM tests and prescribed assignments could choose math activities from a suite of DM tutorials (providing repetition of the problem explanation, partial or complete explanation of the problem, and additional practice problems), workouts (sets of complex problems), or progress feedback and reports. Students frequently contrasted the variety and choice of math activities in DM with the limited set of questions in their regular math textbook: "With DM the choices are more fun and there's more of them than over here [regular math class]." Students enjoyed having opportunities to become informed and make choices about their math learning with DM: "Well instead of just, like, being told what to do, you get to think about what you're gonna do. Like you can choose what you wanna do." One student explained that the activity choices in DM enabled him to control what and how he learned math: "You can go with what you want to do, and what you think you're capable of learning. I like that you can go at your own pace… You're not held back by other people." Researcher observations suggest that when using DM, students made instructional choices that supported their own math learning.

For example, as students gained in their understanding of the DM activity system, they used the activity options within DM tests, tutorials and workouts to increase their individual access to detailed explanations of math problems. Although students were not instructed by their teacher to use the DM *test feedback*, *test report*, and *progress report* activity options, they discovered and employed these tools to review, reflect upon, and regulate their own math learning with DM. Students who scored their DM math test used instantaneous test-feedback to compare their own answers to test questions with the correct DM responses provided. The correct-answer feedback provided in DM enabled students to identify the source of their errors by reviewing and reinterpreting both the test question and their own problem solving strategies. As one student explained:

> …you just say, "Score test!" and then it tells you what you got, and you can go back, and see what the answer should have been and stuff. That kind of makes ya try and figure it out, like, why you didn't get the right answer. It shows you the right answer. So you know how to do it.

The following example represents one-student's verbal response to test-feedback provided on the first part of her test on integers:

> Oh, why did I do that? Oh! I don't know why I did that! This one was easy, from least to greatest. What did I put? [Locating her own response] What the heck! I put them from greatest to least! For [number] 38 [Pause] Oh, I didn't divide! I never found the average. I was supposed to divide by 10! And I bet that's what happened in the last one as well! Now this one is six, negative six. This is positive, this is negative. So how is it equal? [pause] Oh I didn't times it when I got the number! [Pause] I really need to read the questions!

Students used DM test feedback information in this way, to interpret, analyze and improve their own math performance. Clariana (1990) found that students who received correct answers after one missed attempt outperformed students who were required to repeatedly answer questions until reaching the correct answer. Clariana noted that students who received correct answers after one missed attempt used the immediate feedback they received to clarify misunderstandings and use this information to solve successive problems. In the present study, students used immediate test feedback to begin to understand and effect positive changes in their own learning.

Students who completed and scored a teacher-assigned DM test also received a DM test report which provided information regarding the number of correct, incorrect and attempted problems, the students' percentage score, and the student's performance on individual learning objectives assessed within the test. Students learned to use the progress report data provided (e.g., percentage of problems correct for each activity, amount of time spent on each activity, and date the activity was completed) to identify gaps in their progress, plan make-up work and navigate the activity options within DM. They frequently used these accessible and transparent reports of their DM work to critically appraise their own progress with the learning system.

Students' sophisticated use of feedback and report tools to effectively control their own learning in the DM class suggests that learners can develop the skill and will (McCombs & Marzano, 1990) to manage their own learning, given educational technologies which provide detailed, accessible, and instantaneous feedback to s tudents regarding their learning.

Multiple Representations of Math Concepts

Students also contrasted the multiple and dynamic methods for representation of concepts (audio, visual-graphics, visual-text), in the DM scenario-based math problems, with the static problem sets assigned in their regular math textbook. "The workbook pages are just black and white. It's hard to concentrate in the math class. DM is colorful, and it's more fun. It has cool graphics and pictures and things. You can just listen to the math on there." Students frequently noted the benefits of the multiple pathways to learning (speech, graphics, text) provided in each DM tutorial and workout explanation. They suggested that these three modes for representation of problems supported their interest and engagement in math during their completion of DM problem tasks.

Referring to the audio presentation of math concepts in DM, one student insisted, "It makes it [math] more interesting. And the voices, they say it in a fun way, not like in a serious way, or like a baby way." A peer added, "You understand things way better when you're hearing somebody say it than when you're just reading!" Students noted that the visual representation of math concepts in DM also increased their interest in the DM math activity: "If you have something that you see there that catches your eye, you actually want to do it [math activity]." Students liked the use of animated graphics to support scenario-problems in DM, and claimed that these graphic representations of math content supported their understanding of underlying math concepts:

> They give you a lot of pictures and stuff that help. The one sheep thing, like when he was cutting the wool off the sheep to make the things, they had the little sheep in the little circle. Then they colored the circle that had the cut sheep, and they showed you the fractions for how many cut sheep there were to the whole bunch. So, that's a picture that I found helpful to use. Besides trying to figure it out in your head, you have it right there on the computer screen. You can just count it, one by one.

Students noted that in addition to the audio and visual representation of math concepts provided in tutorials and workouts, the step-by step text based explanations of math concepts in DM also supported their engagement in the math activity. One student explained, "They write out the problem for ya in steps. So its easy to follow."

Students suggested that these three formats (speech, graphics, text) for representation of math concepts in DM motivated them to attempt math problems, and sustained their interest in completing difficult word problems:

> I find it hard to do the story problems. I think I got a lot better at 'em in the lab... Because before when I'd do 'em out of the book, I just [pause] I can do 'em, I just keep, well, I have to read that little paragraph thing there and I always get lost.

In their research comparing the performance of sixth grade students using single-representation (SR) and multiple-representation (MR) versions of a computer-based multimedia program for addition and subtraction of signed numbers, Moreno and Mayer (1999) also found that that the benefits of using MRs with students were strongest on difficult problems. Students in the present study claimed that the multiple formats (audio, visual-graphics, visual-text) for representation of math concepts in DM supported their engagement with difficult math problems, by allowing students to choose how they wanted to engage with the math problem.

Given these three formats for representation of math concepts in DM, *control* over the instructional event (the math activity) remained a critical factor motivating students' interest in math when using the interactive learning system to complete math problems. One student explained, "You can decide if you want to listen to the problem, or look at it... so you can't get lost. It [choice of representational formats] makes it [math] more interesting." This research suggests that multiple pathways to learning which support diverse learning preferences among students may positively affect their interest in subject matter. Hannafin and Sullivan (1995) found that students using either *text-plus-static graphics* or *text-plus-animated graphics* methods for presentation of math topics expressed a more positive attitude toward math than those who viewed the text-only version. In this study, the flexibility of the educational technology in facilitating multiple representations of information enabled students to learn in ways that supported their own pedagogical preferences. Consequently, students found math more interesting when learning with the DM interactive learning system which presented math problems through more than one modality, than when using the math text in their regular eighth-grade math class.

Opportunities for Peer Discussion

In the regular math class using the Saxon scheme, students would quietly complete their practice set following the teacher's correction of homework and presentation of the new increment. The teacher neither provided guidelines regarding whether or not students could interact with one another during the DM math class in the computer lab, nor organized formal groups or pairs of collaborators. Students spontaneously devised strategies to extend their experience with DM beyond their individual interactions with the interactive learning system to their peers in the math class. For example, many students made exhaustive efforts to synchronize their use of DM tutorials, workouts and tests with those students seated on either side of them. Students who coordinated their pacing of DM activities in this way consistently demonstrated high levels of interest and enjoyment in the math activity which often proceeded in game-like manner with frequent choruses: "Ready, Set, Go!" "One, two three!" "Marks, set, go!" Students in Mrs. Hall's classes enjoyed learning math with their peers. Many students indicated that the quality of the math experience improved significantly when they had opportunities to work with one-another, and make instructional decisions. One student explained:

> It's a different environment thing. You know you're just sitting around doing things, and you find out something new and neat that you just got to show some one, you know, like the people around you. Or if you're getting frustrated with something, the other people are there to like, talk to you about it.

Students rarely sought assistance with DM math problems from their teacher, relying instead on their peers for math conversation and argumentation. Students' discussions of math while using DM progressed through a sequence of stages that included advice-seeking, advice-giving, evaluation, comparison, clarification, acceptance or rejection of alternative rationales and defense of math claims or assertions. Table 1 presents examples of student math talk at each of these stages:

Table 1. Components of Students' Math-Talk when using DM[a]

Activity	Examples
Request help	"Which one do I click on, here?" (seek advice) "Oh man! What's this about, anyway? (seek help interpreting) "What's an absolute value, again?" (seek definition)
Provide assistance or advice	"Click that one, man!" (provide answer without justification) "Because that's relationship." (provide partial explanation) "Because it's the difference from Jack's home to the school. Do you see that there?" (provide explanation) "Because it's five over two." (provide example of math concept)
Evaluate or compare options	"That looks wrong." (assess) "This one is better." (compare) "Yeah, I had that one figured out, too." (compare, contrast)
Seek clarification	"How do you know it's that one?" (seek justification) "You did what, again?" (seek reiteration of suggestion) "So why did you do that, there?" (seek justification)
Accept option	"That's true." (agree) "Cool!" (accept without indicating motive) "Yeah! That's what I was thinkin' – divide and then simplify. I got that too!" (accept as confirmation)
Reject option	"No it's not! That's a proper fraction there, JM!" (contradict) "No. Eight's the denominator here." (explain) "See, smartie! I told you it was this one, not a whole number!" (self-applaud)
Defend choice	"Oh, no it aint! That's the opposite of an improper fraction, there, GS!" (reject, justify) "It has to be this one – I know those are all wrong!" (justify by elimination) "If you add them up you'll get four sixths, and that has to be two thirds in lowest terms." (recall mathematical proof)

Note. [a] Excerpted text from students' classroom conversations

The informal nature of students' math-talk (frequently punctuated with vociferous argumentation, lavish expression and theatrical gesture) during their use of DM belied the depth of students' discussion of math concepts. Through the production of argument and counter-argument, students frequently attempted to persuade their peers that certain choices or decisions were preferable to concurrent choices or decisions in resolving DM math problems. Students demanded support and justification for mathematical assertions and claims presented by their peers: these demands were met using mathematical data, facts and evidence.

While this research supports the claim that novel educational technologies can trigger a restructuring of classroom experience, one which extends and elaborates the possibilities for student interaction (Kerr, 1996), it also shows that the social situation for students' use of educational technologies, can be a powerful determinant of their verbal behavior in these learning environments.

Increased Interest and Engagement in Math

For the three reasons discussed (activity choices, multiple representations of math content, and opportunities for peer collaboration) students claimed that using DM increased their interest in, and engagement and productivity with, math: "The choices are just more fun, and there's more of them, and it's more interesting to see an' hear the math. You're just busy all the time." One student explained, "With DM you actually want to do the math, then. And it means you actually want to work harder and, like, get it done, and see how much you can cover and stuff." Another student contrasted his poor work ethic in the regular math class, with his sense of efficacy when learning with DM: "Well here I could actually get my work done. I could actually do my work in here. Over there I would do nothin' cause I'm lazy and it's boring. Here it's a lot better... DM helps. It gets you to like it a little more, so you actually get to do stuff. You want to do work: you don't just sit there."

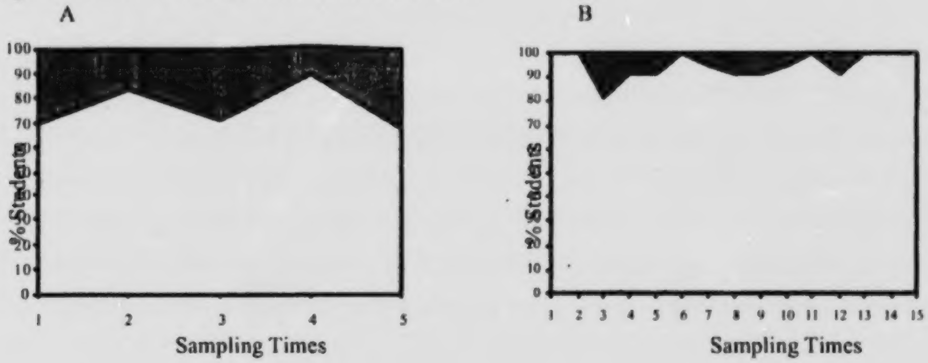
My observations of students' math discussions and activities with DM supported their self-reports of increased engagement with math in the DM class. During their first visits to the computer lab to use DM, I noted that students accessed the system with little delay, engaged in math-talk with one another, completed prescribed assignments, and frequently remained in the computer lab beyond the five-minute bell which signaled the end of math work in the regular math class. To document students' level of engagement with math when using DM, I routinely described the activities of a random sample of approximately one third of the students in each of the eighth grade math classes approximately ten minutes into each class session with DM, occasionally repeating the activity with a new sample of students ten minutes before the end of each session. Table 2 summarizes the activities demonstrated by students while using DM in the computer lab, classified as time-on-task and time-off-task, based on 21 recorded observations (one for each student sample) taken in 15 DM math classes

Table 2. Description of Time-on-Task Categories

Time-on-Task	**Time-off-Task**
Student engaged in math talk: Student discusses math with peer or teacher Student reads or thinks-aloud math	Student talk is not about math: Student asks peer for gum or candy
Student engaged in math activity: Student performs calculations using calculator or paper Student proceeds from one screen to another without visible distraction	Student activity is not about math: Student reads book of English poetry
	Student is disengaged from math activity: Student randomly clicks buttons on screen without obvious purpose or progression Student closes DM program and logs off computer before the 5 minute bell
	Student faults hardware for time-off-task: Student restarts computer Student changes monitor settings Student handles power chords

To further explore students' claims of high levels of engagement with math in the DM class, I used the categories represented in Table 2 to classify the behavior of each student within each observation sample as either on-task or off-task. Figure 2 presents a graphical representation of this time-on-task data, which was taken for students in both their regular math class, during the four-weeks prior to the implementation of DM (Figure 2 A), and in the DM math class during the ten-week implementation process (Figure 2 B):

Figure 2. Students' Time-on-Task in the Math Class



In contrast with Figure 2 A which represents descriptions of students' time-on-task in the regular math class, Figure 2 B shows that an average of 95% of students were found to be on-task with math, when using DM. From the first until the final log, there is very little variation in students' time spent on-task, while using DM. Students' engagement with math in the DM class, defined operationally here as time-on-task, began and remained high throughout this ten-week implementation of the interactive learning system for math. This analysis supports students' claims that they were more interested in math, and more engaged in math activities when using DM, compared with their regular math class, using the Saxon math scheme.

Conclusions and Recommendations

Existing research advocates the use of educational technologies in classrooms to increase students' interest in specific subject matter (Webster, 1990; Yusuf, 1995). The present study supports this claim, and proposes that the level of learner-control afforded to students by an educational technology is positively related to students' level of interest in, and engagement with, the subject matter. Researcher observations of students' use of the interactive learning system in their math class, combined with individual and focus group interviews with students, suggest that the activity choices, multiple representation formats for learning, and opportunities for peer discussion of math concepts which students experienced when they used DM to learn math, increased students' interest in math, and resulted in high levels of engagement with math. Students experienced high levels of control over the instructional enterprise, when using the interactive learning system.

While learner control has generally been used to refer to the delegation of instructional decisions to learners regarding the sequence and pacing of instructional activities and the identification of learning needs (Johnson and Johnson, 1996), this research suggests that learners' decisions regarding the social context for their learning are also critical to our understanding of how learner-control evolves during the classroom implementation of educational technologies. Further exploration of students' math talk while using educational technologies for classroom learning would inform our understanding of how students support one another in developing learner-control strategies during the initial implementation of educational technologies in their classes. This research would enable us to identify strategies that students adopt or co-create to control their own learning using linear and open-ended learning systems in classrooms.

This research suggests that in classroom environments which afford opportunities for students to display what they know and what they can do when using motivational educational technologies, students' classroom conversations, or math-talk may provide compelling evidence of their understanding of math concepts. Implications for classroom practice include providing opportunities for students to engage in sense-making practices with their peers as they work to understand mathematical concepts. As educators, we are called to redress our unfamiliarity with children's ways with words (Heath 1983) - their ways of organizing their experience and expressing meaning, and examine how technology enhanced learning environments may provide a catalyst for exploring evidence of understanding in students' classroom conversations.

This study shows that by increasing students' opportunities exert their own instructional preferences in learning required course content, educational technologies may positively influence students' interest in, and engagement with, subject matter. In light of the tangible benefits for students, this research challenges us to further explore the evolution of learner-control in technology-enhanced learning environments, and thus re-examine the role of the learner in instructional contexts.

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School Library Media Specialists and Fair Use: The Ultimate Gray Area?

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Introduction

As library media specialists, we often find that we are considered, along with our administrators, the school experts in copyright law. Questions we may ask ourselves, given such issues, include: (1) Am I liable if people in my school violate copyright law with library media center (LMC) materials and/or equipment? (2) How can I stop illegal copying of computer software in my school? (3) Are schools exempt from fair use guidelines when using print and non-print media for instructional purposes? (4) How can I encourage teachers to comply with copyright law? And, (5) is copyright law really a "gray area?" These questions and more will be addressed in this article. We will look first at copyright law and fair use, as well as the educational multimedia guidelines – two areas which support some copying without obtaining author or owner permission.

What is Fair Use?

Section 107 of the 1976 Copyright Act covers "Fair Use," a legal principle supporting some limitations to copyright holders' exclusive rights. Therefore, Fair Use is law. What this means for us in the school library media center, is that we, our faculty, staff, and students may use portions of copyrighted materials depending on:

(1) purpose and character of use;
(2) nature of the work;
(3) portion being copied; and
(4) marketability of the work.[1]

Fair use factor #1, the purpose and character of use, covers how the user wishes to use the copied materials. Copying of a nonprofit, educational, or personal nature, tilts in favor of fair use. Copying of a commercial nature tilts in favor of the copyright owner. This means, in some instances, that an educator may make multiple copies of certain works for teaching purposes but may not sell these copies. This fair use factor also supports quotations integrated into a paper or project, whether in print or electronic format.

. Fair use factor #2, nature of the work, examines characteristics of the work under consideration for copying. It considers whether the work is fact or fiction, published or unpublished. Nonfiction, published, print works are most likely to be considered fair use, given this factor. This means that a factual article on the history of instructional technology (IT), published in a professional IT journal, is more likely to be copy-able than is an unpublished story written by a leader in the field.

Fair use factor #3, portion being copied, considers how much of the work the user wishes to copy. Given this factor, he smaller the amount used, the better. However, the law does not provide exact amounts. Instead, fair use factor #3 is evaluated two ways: quantitatively and qualitatively. Quantity, the more easily measurable piece, considers the amount copied relative to the whole as well as the amount needed to achieve the copying objective. Qualitative measurement is much more creative. This measurement is concerned with the concept of substantiality, whereby the copying of the heart of the work—no matter how small—is too much. An example of this might be a two-hour long video, from a particular school library media center (SLMC), whose whole story-line culminates with a minute-long clip on the most challenged item to remain on the shelf in that SLMC. Although the culmination point is very short, if that is the heart of the video, then that particular clip is too much to copy.

Fair use factor #4, marketability of the work, involves the effect that copying part or all of a particular work will have on the commercial marketplace. This factor focuses on economics. For example, if the copying of the work will affect how much money the copyright owner can earn off sales of that item, then any copying may be too much. In terms of this fair use factor, the person copying needs to ask the question: Is my copying this item going to hurt its' marketability?[2,3, 4]

While users and owners/creators of works may differ widely in their interpretations of the fair use factors and the applicability of these factors to various circumstances, the more common interpretations of the four factors are those discussed above. It is important to remember that all four of these factors should in place for any copying to be considered legal under copyright law. Next, we address the educational multimedia guidelines.

Educational Multimedia Guidelines

The Educational Multimedia Guidelines are **not** law and are much more restrictive than the fair use factors covered above. However, these guidelines are supported by many user groups and organizations representing owners, because the guidelines, if properly followed, do not normally violate copyright law. Accordingly, the user may borrow (the smaller amount the better):

Motion Media: 10% or 3 minutes
Text: 10% or 1000 words
Music/Lyrics/Music Video: 10% or 30 seconds
Illustrations/Photos: 5 by an individual artist/photographer; from a published collected work: 10% or 15 images
Numerical Data Sets: 10% or 2500 fields/cells 5

These guidelines are for multimedia projects only and are **more** restrictive than copyright law. However, many users apply these guidelines to all types of media under the assumption, since they are so restrictive, that they will then not be liable for any copyright violations. This is often true, but does not have to be so. What individual owners or creators may want for the use or copies of their works varies greatly. 6

Am I liable if faculty in my school violate copyright law with library media center (LMC) materials and/or equipment?

This question relates to school library media specialist (SLMS) liability. Answer: copyright law follows the "chain of command." Thus, the SLMS might find him/herself included in the list of those in violation, even if s/he had no knowledge of the violation, IF s/he had provided the equipment or materials used in the illegal copying. The school administrator could also be held liable, as another step in the chain. [7]

How can I stop illegal copying of computer software in my school?

Physically, you may not be able to. However, you can make such copying harder to achieve, by keeping all archival software copies under lock and key, keeping a record of all software licenses in an obvious place, teaching and informing your users of fair use and other copyright law applications, and placing notices that illegal use of the equipment for copying may result in fines or imp risonment on all equipment that can be used to copy. [8]

Are schools exempt from fair use guidelines when using print and non-print media for instructional purposes?

A quick and dirty answer: no! However, many owners, publishers, and others who represent those who own or create copyright works have criteria which may make some copying for educational purposes OK. Each work must be viewed individually to see if it would be in violation or not. 9

How can I encourage teachers to comply with copyright law?

While there is no one answer to this question, there are many things which can make copyright compliance more obvious to faculty. Such items include: by example (The SLMS demonstrates proper copyright compliance.); providing current copyright information; keeping all archival software copies under lock and key; keeping a record of all software licenses in an obvious place; faculty in-services, i.e., teaching and informing your faculty of fair use and other copyright law applications; and placing notices that illegal use of the equipment or materials for copying may result in fines or imprisonment. [10] In addition, the SLMS may work alone or in tandem with other teachers to teach copyright compliance to students. Thus eventually, students may observe and also encourage teachers to be copyright compliant.

Conclusion: The Ultimate Gray Area

Copyright issues are often considered the "ultimate gray area," because there may be more than one answer to any one question, depending on who is asking, what the medium under question is, who owns that medium, and why copying or use of it is important. However, the bottom line is: it's illegal to violate copyright law – anytime, anywhere, for any reason. Thus, if a user is sure that s/he wants to use or copy a work, and such use/copying falls outside the fair use guidelines, it is important to make sure permission has been obtained from the owner/creator of the work or....don't copy.

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The Design of *Alien Rescue,* Problem-Based Learning Software for Middle School Science

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Abstract

The growing interest in the field of educational technology in the design of constructivist learning environments has led to a renewed examination of problem-based learning (PBL), an approach to instruction in which all learning results from students' efforts to solve a complex problem. Concurrent advances in technology make it possible to use this approach with a wider range of audiences than have traditionally used PBL, yet few guidelines exist for designers interested in creating computer-based PBL environments. This paper presents some of the lessons learned from the process of developing Alien Rescue, winner of the 2001 Learning Software Design Competition sponsored by the University of Minnesota.

Alien Rescue

Alien Rescue is a computer-based PBL program for use in sixth grade science classes. The primary learning objectives of *Alien Rescue* focus on the solar system and the scientific instruments used to investigate it, though the program offers ties to other areas of the curriculum, including writing and mathematics.

The science fiction premise of *Alien Rescue* takes students to a newly operational international space station where they become a part of a worldwide effort to rescue alien life forms. The program begins with the 7-minute long Opening Scenario, which presents the central problem of the program, and which students, acting as scientists, are asked to participate in solving. A spaceship carrying six species of aliens fleeing their own planetary system have arrived in Earth orbit. Their ship was damaged during their voyage, and except for their engines and computer databases, little of their technology continues to function. In order to survive, they must find new homes on worlds that can support their life forms. Having picked up Earth broadcasts, the aliens learned our languages with the intention of asking for our help to relocate to worlds in our solar system. However, when their life support failed completely, the aliens could only complete a distress message to be sent once they reached Earth orbit, then entered a state of suspended animation, where they must remain until they are safely relocated to suitable worlds.

Students are informed that they are just one of many teams of scientists participating in this rescue operation, and that their task is to determine the most suitable relocation site for each alien species. In order to solve this problem, students must engage in a variety of activities. They must learn about the aliens and identify the basic needs of each species. To do so, students search the Alien Computer, which they are informed was moved from the alien ship to the international space station so that they could conduct their research. They must then investigate the planets and moons of our solar system, searching them for possible matches with the needs of the aliens. Students gather this information in two ways. They can search the Solar System Database, a resource within the program containing information about the sun, nine planets, and ten of the large moons of our solar system. Then, to gather needed information that is missing from the Solar System Database, students can use a simulation within the program that allows them to design and launch probes to other worlds. Students interpret the data returned from these probes, applying the information they glean back to the problem. Finally, students must use the information they gather to select a new homeworld for each species and justify their decisions. They identify their choices and write a rationale for each choice in the Recommendation Form. To discourage students from developing a solution without time for adequate investigation, the Recommendation Form does not appear on screen until students have used the program for 300 minutes.

To support students as they work toward developing a solution, *Alien Rescue* offers the Expert Tool. This tool provides video of a character who is scientist working on the same problem as the students as he interacts with the resources within the program. The expert models his process as he works on finding a home for one of the species. He does not help students with the other species, nor does he direct them to work in a particular way. However, by making explicit the strategies an expert brings to bear as he works on the problem, the Expert Tool supports students in developing effective problem-solving strategies.

Alien Rescue is an example of a student-centered learning environment. Students are engaged in a complex task, but they determine and control their process. Yet they are not expected to determine this process or develop a solution on their own. *Alien Rescue* was designed to be used in classrooms rather than as a product for home use, and we consider the social negotiation that occurs as students interact with their teacher and peers to be an essential source of support for learning through this program. The teacher, working as a facilitator, pushes students to articulate their planning and reasoning, challenges their misconceptions, promotes peer collaboration, and builds connections to a wide range of scientific topics. Peers provide support for the complexities of the environment and help each other to refine their understandings as they discuss/argue the merits of alternative solution plans.

Problem-Based Learning

PBL is an instructional approach in which learning occurs as a result of students' efforts to develop a solution to a complex problem. Instruction begins with the presentation of a problem situation. Students work in teams to identify problem constraints, form hypotheses, collect and analyze data, and develop a solution plan. Along the way, students discover that they need a great deal of factual information in order to understand the problem, determine all their options, and develop a viable solution. In order to collect it, they use the same tools experts would use: existing informational resources such as books and computer databases, and domain specific tools such as microscopes, calculators, or maps.

The literature on PBL has suggested a number of benefits for this approach, including high levels of intrinsic motivation (Albanese & Mitchell, 1993; Stepien, Gallagher, & Workman, 1993), enhanced problem-solving skills (Gallagher, Stepien, & Rosenthal, 1992; Williams, 1993), and more effective self-directed learning (Aspy, Aspy, & Quinby, 1993; Blumberg & Michael, 1992). Despite the potential for learning that PBL offers, the realization of these benefits is far from assured. The success of PBL depends on students' "willing cognition," their intrinsically motivated efforts to gather the information and develop the skills they need in order to create well-reasoned solutions. Without this investment of cognitive effort, students may fail to recognize the relevant nuances of the problem, neglect to identify pertinent learning needs, or rush to develop solutions that turn out to be non-viable. Establishing and maintaining this willing cognition in students must therefore be an overarching goal for designers of PBL programs.

Guidelines for the Design of PBL Programs

While the design of *Alien Rescue* was informed by both theory and research, a number of additional insights arose through the process of development and testing. In the remainder of this paper we share some of these insights in the belief that they can help to guide the design of future computer-based PBL environments. The following suggestions address issues related to the design of the central problem of a PBL program, the informational resources provided, the program interface, and the support materials for classroom teachers.

Develop an interesting and rich problem that creates a need for information and multiple applications of key strategies. The most important design task in the development of a PBL program is the creation of the central problem. This problem will affect students' willingness to take ownership over their process and learning. It will also determine what learning needs students identify and, as Stepien, Gallagher, and Workman (1993) point out, what information they must "run into" in order to solve the problem. To promote students' "willing cognition" and maximize the potential for learning, the central problem of a PBL program should have five characteristics. First, it should be *interesting* to the target audience in order to promote students' ownership over their process and solution. For example, in our early planning phase for *Alien Rescue*, we initially considered having students identify a world for human colonization. We eventually decided that students would find aliens more interesting and would therefore be more intrinsically motivated to invest cognitively in solving the problem.

Second, the problem needs to be *challenging*, so that a solution does not seem obvious. Students are accustomed to well-structured problems where all necessary information is presented in the problem itself, the problem has a single correct solution, and the time to solution is relatively brief. If students perceive that the problem is not challenging, they may fail to recognize the need for additional knowledge and "solve" the problem without fully understanding it. Once students believe that they have completed their work, they may be reluctant to invest further cognitive effort in developing a solution.

Third, the problem needs to be *manageable* so that students persist in their efforts to develop a solution. As students recognize the complexity of the problem, they may become frustrated if they believe that it is too difficult or that they cannot learn all they need to know in order to develop a solution. Balancing challenge with manageability and effectively communicating both to students can be quite difficult. In our testing with *Alien Rescue*, we have found that students generally recognize the challenge relatively quickly, but take some time to recognize its manageability. With six species of aliens, each with a different set of needs, and nineteen worlds to consider as possible homes for them, the problem requires students to conduct a great deal of research, a fact which they recognize as they come to understand the problem. Early in the program we have seen some students express some apprehension and frustration as they experience uncertainty about what they should do and are unable to solve the problem quickly. This typically evaporates as students come to understand the resources within the program and begin to develop a process to work toward solution. What gets students over this hurdle and keeps them cognitively engaged is their interest in the problem and in the virtual environment in which the problem is set. In this way, the rich media and interesting tools provided within the program may serve to motivate students to persist long enough to recognize that they can manage the challenge the problem presents.

Fourth, the central problem of the PBL program should *cause students to recognize the need for information and skills.* When students recognize that they do not have all of the information they need, they seek it, and it is this effort to meet these learning needs that drives students' investigation and which results in their natural acquisition of key terminology, factual information, and concepts within the problem domain. Because students have determined the need for certain knowledge and have identified a method for acquiring that knowledge, all their learning is meaningful to them. It is therefore essential that the problem lead learners to recognize that they do not have all of the information they need to develop a solution.

Finally, the problem should *create multiple opportunities for students to apply the same problem-solving strategies* in order to encourage students to reflect on and refine them. In *Alien Rescue,* students must select homes for five species of aliens (the expert recommends a solution for the sixth). While the needs of each species are different and the conditions on each world vary, the process for developing a solution for each species is basically the same. Students must consider different factors and constraints, but they can apply the same problem-solving strategies. This gives students an opportunity to refine their process and reflect on what is effective.

Design miniature problems into the environment. PBL provides not only a problem but also a context in which that problem takes place. While it is impossible for designers to control all aspects of the PBL experience, it is possible to design small complexities into that context that learners must encounter in order to solve the problem. The need to cope with constraints, determine alternative resources for data collection, and interpret data provides challenges that encourage deep thinking and an ongoing need for the development of problem-solving strategies. This helps a PBL environment to reflect real world problem solving, where overcoming numerous hurdles is a common necessity. These miniature problems also provide opportunities for rich discussions on science.

One example of a miniature problem built into *Alien Rescue* occurs in the alien computer. Rather than using the names of elements to communicate the composition of their atmospheres, the aliens show spectrograms. Spectrograms show the spectral signature of an element; the spectrogram of each element is unique and universal. The aliens communicate this information using spectrograms ostensibly because they were unable to learn the English translation for elements. However, students this age have never encountered spectrograms and are confused by them when they see them in the alien computer, yet they recognize a need for the information these spectrograms communicate. A number of things happen in class as a result of this miniature problem. First, the teacher can decline to tell students how to get the information they need to interpret the spectrogram and instead use this problem as a vehicle for encouraging collaboration and peer interdependence. Second, it challenges students to investigate more deeply, actively exploring the environment to figure out how to solve this problem themselves. As some students do solve it, they become experts on this particular problem, and when their peers seek help they can provide it. Finally, these miniature problems provide a jumping off point for rich class discussions. For example, the spectrogram problem can lead to discussions on spectroscopy or starlight. The miniature problems within *Alien Rescue* can lead to class discussions on a wide variety of science topics, including radio waves, magnetic fields, Galileo and the moons of Jupiter, geological activity, supernova, ice, gravity, meteors, and atmospheres.

Provide access to all necessary information within the environment without suggesting the usefulness of that information in the development of a solution. One reason that teacher development of PBL programs is so difficult is that students must have access to an adequate number of resources to meet their learning needs, but not so many that they are overwhelmed and unable to find the information they need. By providing all necessary information within the program, designers of computer-based PBL programs can assure its accessibility. However, providing a single, well-structured informational resource can limit the range of considerations students make, suggesting a solution without requiring sufficient cognitive effort on the part of the learner.

Because one of our goals in Alien Rescue was to promote students' mindful search for useful information, we wanted to avoid providing resources that encouraged a passive page-turner mode of use, or which were structured to suggest certain solutions. To accomplish this, we used two strategies to maintain the complexity of real-world problem solving and create a need for students to work purposefully. First, more information than is needed is included in the program so that students must discriminate between what is useful and what is not. For example, the alien computer contains information about the aliens' needs, but it also contains information about the uninhabited worlds in their solar system, their journey, and their languages. Second, the needed information is divided among multiple tools so that students must consider a variety of data sources. Some of these resources are purely informational, while others require students to conduct investigations to collect data. For example, the Solar System Database contains text and graphics, while the probe simulation requires students to design probes, launch them, and interpret the data returned from them. Taken together, these strategies encourage students to think about what information they need before conducting research so that they are not overwhelmed by irrelevant facts. This balance of accessibility and complexity makes it possible for learners to be successful within a challenging program.

Use spatial relationships to help users become familiar with the tools available within the environment. The large number of informational resources and organizational tools users need within a PBL environment presents a challenge for the design of the interface. Information buried several layers deep within the interface may never be found. By their very nature, the problems used in PBL occur within some context; a computer-based program can exploit this quality by creating a virtual setting for students' work. By structuring this virtual setting so that spatial relationships are established among the resources, the interface can help learners understand and remember how to access useful tools.

Alien Rescue contains thirteen tools, most with different purposes and interface features particular to themselves. To help learners understand the variety of these tools and their relationships, we created a two-level interface. The first level is the international space station, a futuristic virtual environment which consists of five rooms that learners can navigate among, using the arrow keys on their keyboards. These rooms contain resources students will only need for part of the program. The second level is the goggles interface. In the Opening Scenario, students are told to imagine that they are wearing goggles that provide access to a variety of tools throughout their work. Tabs along the sides and bottom of the screen provide access to these tools, and students can open and close them using the mouse. This two level interface creates relationships between the tools that supports students in discovering and remembering how to access the wide variety of resources available within the program. Our testing with *Alien Rescue* has shown that students are typically able to navigate easily among the various tools by the third day of class, quickly accessing the tools they need to conduct their work.

Create the need, opportunity, and support for collaboration. The need for information that is not instantly apparent, a rich context, and the occurrence of numerous small problems within a PBL program all add to the complexity of the task. Unable to handle this complexity individually, students naturally seek support. In *Alien Rescue,* we typically witness students first turning to their teachers for help. But when the classroom teacher refuses to solve their problems for them and instead directs them toward their peers, students begin to understand the value of collaboration. Allowing and encouraging a collaborative environment within the classroom leads students to see their peers as resources for dealing with difficulties, which in turn can enhance both learning and motivation.

Designers can only control the content of the computer-based programs they create; they exercise little control over the real-world contexts in which the program is used. Therefore designers can only create a need for collaboration. Providing the opportunity and support for collaboration is the responsibility of the classroom teacher. Support materials for teachers should therefore include strategies on how to encourage and support collaboration. The teacher's manual for *Alien Rescue* offers three strategies that teachers can use to support collaboration. First, as described above, teachers can redirect students' questions to their peers. This giving and receiving of help lays a groundwork for more complex forms of collaboration, such as shared planning and division of labor. As some students begin to develop ongoing collaborative relationships with a few peers, teachers can use a second strategy, peer modeling, to encourage greater collaboration among other students. In peer modeling, the teacher asks students who are successfully collaborating to describe their process to their classmates. Teachers may guide this description through the use of specific questions, but they make it clear that students developed and control their own process, and that there is more than one way to collaborate successfully. Through the use of peer modeling, teachers provide students with examples of the logistics of collaboration and legitimize it as a successful strategy for accomplishing complex tasks. Finally, teachers are encouraged to discuss the role of collaboration in the scientific community. One of the goals of *Alien Rescue* is to help students understand the real work of scientists, and that work is usually conducted within collaborative communities. Teachers can describe how scientists typically work in research teams, pooling their various areas of expertise and sharing the responsibility for the investigations they conduct. They can also explain the importance of scientists publishing their findings and building on the work of other scientists. Again, this strategy legitimizes collaboration by framing it as an aspect of the work of "real" scientists.

Designing effective PBL programs is a complicated affair, and this paper addresses only a few of the lessons learned through the process of designing *Alien Rescue*. As problem-based learning becomes a more widely accepted approach, more discussion is needed about effective design principles.

For more information on *Alien Rescue,* visit our website at www.alienrescue.com

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Images of United States and Polish Cultures from U.S. and Polish Perspectives: A Telecommunications Partnership

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Abstract

Trigger visuals (Cyrs, 1997) created by graduate students using MacroMedia Director in a Computer Graphics for Learning course in the United States and in a Visualization for Learning course in Poland were shown. These were shared among the U.S. and Polish students and were discussed in Web-based computer conferences. The content and style of the U.S. students' visuals were analyzed by both U.S. and Polish students as well as the researchers to reveal culture as it was manifested through the students' art shared over geographic distances

Overview

Graduate students in a Computer Graphics for Education course in the United States and in a Visualization course in Poland created multimedia "trigger visuals" using multimedia software. The "trigger visuals" presented a scenario, problem, or opportunity in order to trigger an emotional rather than a rational response from the viewer and to stimulate discussion (Cyrs, 1997). Then students attempted to share their visuals with each other as Web documents on a shared Web site and discussed their contents in computer conferences. The content and style of the U.S. students' visuals were analyzed by both U.S. and Polish students as well as the researchers to reveal culture as it was manifested through the students' art shared over geographic distances.

Theoretical Framework

Multicultural understanding is the appreciation of both similarities and differences as well as beliefs, experiences, values, and behaviors across distinct and identifiable cultures within and across groups and societies (Timm, 1996). A group's beliefs, experiences, values, and behavior can be revealed through its artistic creations. Artistic style is "visual synthesis of the elements, techniques, syntax, inspiration, expression, and basic purpose" (Dondis, 1973). This style "describes the means by which aesthetic ends are achieved, the values reflected in those ends, and the culture within which those values prevail" (Mullet & Sano, 1995).

Several telecommunications exchange projects have emphasized the educational goals of equity and multicultural understanding. For example, AT&T Learning Circles were found to reduce isolation and broaden students' experiences (Riel, 1995). Similarly, rural Ohio high school students who exchanged email with adult mentors realized that, "[t]he components of a meaningful life had apparently changed as a result of their interaction with others from outside their usual circle of contacts" (Tille & Hall, 1998, p. 116). Another study explored cultural similarities and differences manifested through children's artwork shared via telecommunications among four teachers and their students in Texas and in Mexico (Cifuentes & Murphy, 2001).

According to Hofstede (1997), cultures differ across four dichotomous dimensions: large vs. small power distance, strong vs. weak uncertainty avoidance, individualism vs. collectivism, and masculinity vs. femininity. These four dimensions are described in depth by Hofstede and can be used to understand and explain phenomena in cultures. For instance, Hofstede used the four dimensions to characterize interactive styles across several nationalities.

Cultures also differ in their communication styles. Hall (1976) distinguishes between high context communication and low context communication. In high context cultures such as that of Poland, communication relies on indirect verbal messages that are dependent on context clues. In such cultures, "very little is in the coded, explicit, transmitted part of the message" (p. 91). Thus students in high context cultures are likely to write less and rely more on the physical context. In low context cultures such as that of the United States, on the other hand, messages tend to be direct, explicit, and highly structured. Understanding these differences is critical for telecommunications partners with different cultural styles. Clearly, there is much to learn from multicultural and intercultural experience.

Methods

An instructor in Texas and one in Poland each required their students to develop trigger visuals. The 20 U.S. students were required to post them on the Web. Four Polish students participated. Students were then encouraged to discuss the contents of the visuals in computer conferences using FirstClass™.

We used the two-phase process of content analysis, open coding and focused coding as described by Emerson, Fretz, and Shaw (1995), to analyze the trigger visuals (*see: Boud, Pearson, 1984; Cullen, 1989; Dylak, 1995*) created by U.S. students and the computer conferences. During open coding we analyzed the visuals to identify ideas, themes, or issues (*if it make sense – inspired or triggered*). This process involved writing initial memos to ourselves (Miles & Huberman, 1994). For focused coding, we examined the visuals as well as our memos on a item-by-item basis, giving special attention to categories identified during open coding, Hofstede's four dimensions, and Hall's theory of context. Doctoral students received training and then examined the visuals to categorize them according to those dimensions and provided a rationale for their categorization. They independently completed a matrix of the dimensions as manifested through the visuals for the U.S. students' cultures. After compiling students' categorizations and rationales in a summary matrix, we paid closest attention to the students' rationales. Next, we will insert our own judgment and understanding to summarize and draw conclusions about the data.

Findings and Educational Value

Artifacts have been collected and analyzed; however, it is too soon to draw conclusions regarding what data reveal about the cultures. Learning networks allow students to virtually cross borders to collaborate with distant others so that they "actively construct knowledge by formulating ideas into words that are shared with and built upon through the reactions and responses of others" (Harasim, Hiltz, Teles, & Turoff, 1995, p. 4).

Learning environments composed of multicultural learners can foster understanding between peoples on opposite sides of geographic borders to fulfill the desirable ends of education (Postman, 1995) and prepare students for world citizenship (Parker et al., 1999). Fabos and Young (1999) charge that one way to "cultivate more critical and political sensibilities among students" is to replace existing theories of the "other" or the "foreign" with ones that "relate the content of telecommunication projects to students' individual and collective lives, that analyze broader social and political issues" (p. 241). This study of shared multimedia explored the possibility of learning how to analyze artifacts to gain understanding of distant others. The study demonstrated that students can share artifacts and then interpret them to learn about cultures. They can gain insight regarding each other's similarities and differences by participating in telecommunications partnerships. In networked classrooms students can connect with distant others to learn about and from their perspectives. In addition, distance technologies can foster team teaching and multicultural relationships across geographical distance.

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Visualization for Construction of Meaning During Study Time

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Abstract

This study investigated skills that lead to generation of facilitative visualizations during study time for college age students. An orientation prepared students in an experimental group to 1) identify the underlying structure of a given text, 2) represent identified interrelationships, 3) generate pictorial as well as verbal study-notes, 4) visually connect concepts to prior learning, and 5) illustrate distinctive features of concepts. Students who showed interrelationships among concepts in their study-notes performed better on a test on science concepts than those who did not. No other significant effects were identified.

Background and Theoretical Perspective

In Visual Communicating, Wileman defines visualization as the process of graphically or pictorially representing facts, directions, processes, data, organizational structures, places, chronologies, generalizations, theories, and feelings or attitudes (1993). In our study, we are interested in the power of student-generated visualization to facilitate learning. As Dewey remarked early in the 20th century, the work of instruction would be "infinitely facilitated" if teachers would see to it that their students were "forming proper images.... The image is the great instrument in instruction. What a student gets out of any subject ... is simply the images which he himself forms with regard to it." Dewey goes on to say that teachers would be wise to spend time "training the student's power of imagery and in seeing to it that he is continually forming definite, vivid, and growing images of the various subjects with which he comes in contact in his experience" (as cited in Wileman, 1993, p.7).

Student-generated visuals surpass illustrations in their effectiveness for instruction because they are more personally meaningful and relevant to students' understandings and prior knowledge, and because they contribute to construction of meaning (Anderson-Inman & Zeitz, 1993; Finke, 1990; Gobert & Clement, 1999; Papert, 1991). When students are able to manipulate images during knowledge construction, they tend to engage more in the meaning-making process and understand and remember concepts better than through the traditional transmission approach of instruction (Jonassen, 2000). Additionally, students' visualizations manifest the content and the structure of their knowledge of concepts, which provides their teachers with access to their levels of understanding.

Objectives

This study investigated the skills that lead to generation of facilitative visualizations during study time. Specially, researchers examine the effects of teacher encouragement to generate visualizations, the effects of teacher encouragement and orientation to visualization, and the effects of the use of each of four visualization skills and rehearsal on test scores.

Methods

The participants in this study were 75 undergraduate students in an introductory oceanography course at a large university. Twenty participants were sophomores, 22 participants were seniors, and others are juniors. Of the 75 students who attended class to participate, 27 were male and 48 were female. The participants represented 22 majors from throughout the university. Thirty participants were education majors. The other 45 students were from majors ranging from journalism to biology. Participants were randomly assigned to three groups in a posttest-only-control-group design. The data sources included: (a) test scores, (b) students' study notes, (c) "The Student's Questionnaire", and (d) the researchers' journals.

- **Unguided group**-- received 75 minutes of placebo instruction on use of bacteria to clean the Valdez, Alaska oil spill from the investigator. It then received an essay on the ocean's role in the greenhouse effect to study and students were given one hour for unguided, independent study prior to taking a test. Students handed in study-notes before being tested on the concepts of the text.
- **Encouraged-to-visualize group**-- received 75 minutes of the placebo instruction from the investigator. It then received the essay on the ocean's role in the greenhouse effect to study and

students were encouraged to visualize during study time. Students were given one hour for independent study prior to taking test. They handed in study-notes before being tested on the concepts of the text.

- **Oriented group**– was asked to study two paragraphs of text and handed in their study-notes after studying. Based on the analysis of students' study-notes, the investigator was able to classify the students in this group as either visualizers or non-visualizers prior to receiving the orientation. Then, the group received a 75-minute orientation to visualization from the investigator. It then received an essay on the ocean's role in the greenhouse effect to study and students were encouraged to visualize during study time. Students were given one hour for independent study prior to the test. They handed in study-notes and were then tested on the concepts of the text.

Placebo instruction was designed so that all three treatment-groups would spend equal time with the investigator. For the placebo, the investigator presented a research study on the use of bacteria to clean up oil spills.

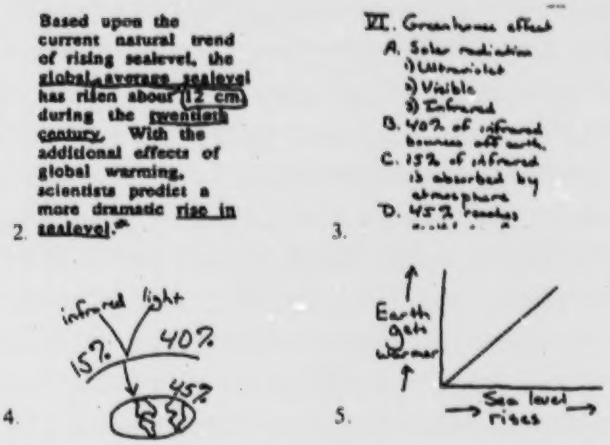
The oriented group received a 75-minutes orientation to visualization. Students examined short text in order to practice identifying underlying structure of that text that can be expressed as one of the following interrelationships— causal, oppositional, sequential, chronological, categorical, comparative, or hierarchical. The instructor then introduced the students to the concept of self-generated visualization as a study strategy. An advance organizer of the four skills and rehearsal was presented. The four skills were — (1) represent identified interrelationships, (2) generate pictorial as well as verbal study-notes, (3) visually connect concepts to prior learning, and (4) illustrate distinctive features of concepts. The instructor modeled generation of visualizations of the text on the overhead transparency. After each example was modeled, students practiced generating visualizations using each of the skills one at a time. They then shared their visualizations with other students and received feedback from the students regarding the effectiveness of the visualization at communicating the text, which was visualized. Because the training and practice time was limited, students had opportunities to visualize short pieces of text containing only one concept.

The easy for studying was 6 1/2 double-spaced pages of text written at the 12th grade level on the ocean's role in the green house effect. All participants took the test at the end of an hour study to determine the effects of the experimental treatment. The test contained 30 multiple choice questions, which was criterion referenced according to the objectives of the test student studied (r=. 86) and was validated by five oceanographers. The test scores were compared across groups.

In addition, three raters analyzed each student's study-notes and notes in the textual material to estimate the extent to which each student applied the four visualization skills when generating study-notes. Application of each skill was estimated on a scale of 1 to 5 on "The Visualization Skills Inventory" (Cifuentes, 1992). For example, if students made no attempt to show interrelationships they received a 1. If they showed interrelationships with numbering, highlighting, arrows, etc. they scored a 2. If they showed interrelationships through the generation of an outline or other primarily verbal means, they scored 3 points. If they showed interrelationships by creating a structural diagram or a verbal/pictorial representation showing one relationship, they scored 4 points. If they showed interrelationships by creating a structural diagram or a verbal/pictorial representation showing more than one relationship, they scored 5 points (see Figure 1). The interrater reliability was reported as r= .97 for showing interrelationships, r= .97 for balanced pictorial/verbal notes, r= .96 for showing relationships to previously know material and r= .99 for showing distinctive features.

Participants were classified as either visualizers or non-visualizers by examining the unguided group and encouraged to visualize group's study-notes that participants generated while they studied "The Greenhouse Effect" and by examining the study-notes generated by the oriented toward visualization group prior to the orientation. If subjects in each of the groups included any visualization in their study-notes, they were classified as visualizers.

After taking the test, all participants filled in "The Student's Questionnaire" that asked them to rate the extent that they had previously been exposed to the information in the greenhouse effect. To determine if groups varied in their prior knowledge of the textual material, an ANOVA was conducted. No difference was found. The questionnaire also asked students to report the extent to which they used their study-notes to rehearse when preparing for the test. The extent to which students' used their study-notes for rehearsal was estimated from question 1 on the questionnaire. Participants who scored a one or a two were categorized as non-skill-users. Participants who scored a three, four, five or six on were categorized as skill users. Additionally, students were asked to describe in detail the steps that they took to prepare for the test.



2. Based upon the current natural trend of rising sealevel, the global average sealevel has risen about 12 cm during the twentieth century. With the additional effects of global warming, scientists predict a more dramatic rise in sealevel.

3. VI. Greenhouse effect
A. Solar radiation
1) Ultraviolet
2) Visible
3) Infrared
B. 40% of infrared bounces off earth.
C. 15% of infrared is absorbed by atmosphere
D. 45% reaches

4.

5.

Figure 1. Skill users vs. non-skill users of showing interrelationships after the orientation (scale of 1-5 on each skill).

We applied content analyses approaches, as described by Emerson, Fretz, and Shaw (1995), to the researchers' journal entries, students' study-notes, and questionnaire results. During and upon completion of data collection, we used the two-phase process of content analyses, open coding and focused coding, to analyze the data and identify factors contributing to the effectiveness or lack of effectiveness of visualization as a study strategy for learning the text regarding ocean's role in the greenhouse effect.

Results

Based upon subjects' self-reports regarding their prior knowledge of the ocean's role in the greenhouse effect, it was determined that groups did not differ in their prior knowledge of the text. However, groups did differ in their use of study time. Most importantly, subjects in the oriented group wanted more study time to prepare for the test while students in the unguided group and the encourage to visualize group wanted less time to prepare for the test.

Regarding subjects' prior knowledge of visualization, 30 of the 75 subjects were education majors and were likely to have been exposed to visualization in education classes at the university. Informal interviews revealed that at least 5 education majors had been exposed to the strategy. Subjects were categorized as visualizers or nonvisualizers based upon their note-taking strategies prior to orientation to visualization. Nine of the 11 identified visualizers were education majors. Results of an ANOVA revealed that there were no significant differences between visualizers and nonvisualizers on the test (see Table 1).

Table 1. Summary of Numbers of Visualizers and Nonvisualizers Before Treatment Per Group and Test Means

	Unguided	Encouraged	Oriented	Total	Mean of Test Score
Visualizer	2	8	1	11	86.06 %
Non-visualizer	18	20	26	64	79.40%

There were no statistically significant differences identified between groups on test scores (see Table 2).

Table 2. Group Contrasts of Performance on the Test

Contrast	df	SS	MS	F	*p*	Effect Size
Unguided vs Encouraged	1	1.37	1.37	0.16	0.69	0.12
Encouraged vs Oriented	1	2.99	2.99	0.34	0.56	-0.24
Unguided vs Oriented	1	0.18	0.18	0.02	0.89	-0.14

alpha = .017

However, ANOVA revealed that students who showed interrelationships among concepts in their study-notes performed better on the test than did students who did not show interrelationships among concepts in their study-

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notes. No other statistically significant differences were found (see Table 3). In addition, Cohen's d indicated a positive medium effect size (d=0.57) for the pairwise comparison of those participants who showed interrelationships in their study notes and those participants who did not show interrelationships. Additionally, the d for the pairwise comparison of those students who balanced their notes pictorially and verbally and those students who did not was 0.37, and the d for those students who connected concepts to their prior learning and those students who did not was 0.34. These practical effect sizes indicate that showing interrelationships, balancing pictorially and verbally, and relating new concepts to prior learning made a significant difference on test scores (see Table 4).

Table 3. Five ANOVA's of the Effects of Four Visualization Skills and Rehearsal on the Test

Source	df	SS	MS	F	*p*
Show Interrelationships					
Between Groups	1	42.61	42.61	5.22	0.02*
Within Groups	73	596.06	8.17		
Total	74	638.66			
Balance Pictorially/Verbally					
Between Groups	1	20.94	20.94	2.47	0.10
Within Groups	73	617.72	6.46		
Total	74	638.66			
Relate New to Old Material					
Between Groups	1	17.41	17.41	2.05	0.15
Within Groups	73	621.25	8.51		
Total		638.66			
Show Distinctive Features					
Between Groups	1	6.72	6.72	0.76	0.38
Within Groups	73	631.94	8.66		
Total	74	638.66			
Rehearse					
Between Groups	1	2.22	2.22	0.26	0.61
Within Groups	73	636.44	8.72		
Total	74	638.66			

* $p<.05$

Table 4. Mean Scores and Standard Deviations on the Test for Those Who Used and Those Who Did Not Use Four Visualization Skills and Rehearsal

Skill Use in Study-notes	N	Test Score Mean	Standard Deviation	Skewness	Kurtosis	Effect Size[a]
Show Interrelationships	52	81.79	9.30	-0.27	-0.42	0.57
Did not Show Interrelationships	23	76.30	9.89	-0.04	-1.23	
Balance Pictorially/Verbally	39	81.82	9.40	-0.27	-0.40	0.37
Did not Balance Pictorially/Verbally	36	78.25	9.93	-0.08	-.097	
Relate New to Old Material	38	81.76	9.15	-0.33	-0.18	0.34
Did not Relate New to Old Material	37	78.50	10.17	-0.02	-1.00	
Show Distinctive Features	45	80.93	9.80	-0.20	-0.68	0.21
Did not Show Distinctive Features	30	78.86	9.72	-0.21	-0.79	
Rehearse	54	80.46	9.36	-0.29	-0.45	0.13
Did not Rehearse	21	79.19	10.91	0.20	-1.06	

Effect Size[a] = $(\overline{X}_{\text{show interrelationship}} - \overline{X}_{\text{did not show interrelationship}}) / SD_{\text{weighted}}$

The subjects who were oriented to visualization by the investigator were asked to describe their reactions to visualization as a study strategy. Comments were generally positive. Twenty-one of the 27 subjects used the words "helpful" or "useful" when expressing their opinions of visualization. However, opinions conflicted regarding the efficiency of generating visualizations. Some students felt that the time visualizing was time well spent; others felt that visualization took too much time for busy students whose time is limited. Opinions also conflicted regarding the amount of effort required to visualize. Some felt that visualization was difficult while others felt that it was easy. Conflicts like these indicate that individual differences between subjects contributed to their opinions of visualization. Perhaps the students who found that visualization was easy and time saving were visual thinkers, while those who found that visualization was hard and time consuming were not visual thinkers.

Educational Significance

The study is important in that it provides evidence in the growing body of visualization research. Based upon the findings, it is recommended that students be trained to represent interrelationships that are causal, oppositional, sequential, chronological, comparative, categorical and hierarchical. More powerful orientations to visualization need to be designed and implemented in order to investigate the effects of using visualization instruction on learning. Training sessions might need to be longer than the visualization orientation in this study and should provide more guidance, practice and feedback with textual material that is representative of the length of material that students are required to remember for classroom testing. A study similar to this study should be conducted allowing for flexible study time. In such a study, students would take the test when they want to so that time would not be a limitation. Based upon student behavior in this study, students trained in visualization skills might choose to spend more time-on-task and, therefore, might out perform untrained students.

Also, upon development of a reliable and valid measure of visual ability, aptitude-treatment-interaction studies should be conducted to determine ways to adjust instruction to students' individual differences. In this study, some students claimed that visualization was easier or less time consuming than other strategies while other students indicated that visualization was harder and more time consuming than other strategies. Perhaps visualization facilitates learning for visual thinkers but does not facilitate learning for non-visual thinkers.

As well as having differing effects on different learners, visualization may enhance memory more for certain kinds of content than for others. Both concrete and abstract prose recall have been shown to be enhanced by visualization. More studies are needed that compare visualization's effectiveness across various learning domains and various subject matter.

College level educators should not require students to visualize in preparation for a test because visualization may interfere with some students' efficient use of study time. However, we have shown that encouragement to visualize will not interfere with efficient study and may provide students with means to interact with the content they are studying. College level educators should encourage learners to visualize using learner techniques for representing interrelationships that are causal, oppositional, sequential, chronological, comparative, categorical, and hierarchical.

Future research should investigate the impact of the use of computer graphics software, such as AppleWorks™ and Microsoft™ Drawing and Painting tools on the effectiveness of student-generated visualizations. Cifuentes and Hsieh (2001) indicate that having students generate their visualization on computers offer several advantages over pen and paper, such as ease of subsequent revision and effortlessness of creating sophisticated looking graphics. However, learners may be distracted by the fun computer software and the computer graphics tools during learning. More studies need to be conducted in schools with reliable computers to further examine the effect of the use of computer graphics tools on visualization learning.

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Interface Design and Software Tools for Creating a Multimedia Program Measurement Instrument

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Abstract

This paper discussed how the author developed the interface for the Multimedia Program Measurement Instrument based on proven design principles from the behavioral and cognitive sciences and using a variety of software. This is a program developed for her dissertation research[4] *which was used for the initial pilot and field testing in the Spring and Summer 2000 semesters followed by a second pilot and field testing and Final Experimentation in the Fall 2000 semester at the University of Central Florida, C&I Instructional Systems. Her study concluded in the Spring 2001 semester. The research study addressed the effect of three types of icon symbol formats viz., abstract, drawing-pictorial, and photographic-pictorial on a user's learning and performance. The measurement instrument consisted of a lesson followed by a quiz on the "Advanced Features of a Digital Video Camcorder". Divided into three parts, the first part discussed the design of the interface and how principles of design were applied for ease of use. The second part of the paper discussed the tools for creating the multimedia program and to capture user's action e.g. clicks and scores on the test. The paper is concluded in the third part with a recommendation for applying similar approach to a variety of uses, whether standalone CD-based or web-based.*

The Design of the Interface

Factors that were given primary consideration in designing the multimedia (Fleming and Levie (Eds.) 1993) measuring instrument interface for ease of use, mental effort (Winn 1993), attention (Aspillaga 1996) and clarity of presentation were: consistency, predictability, simplicity (Haag and Snetsinger 1993) and information density (Mandel 1997 and Tullis 1997). The program interface starts with a 'welcome login' window where the user enters personal information. The whole experiment is concisely and briefly explained using minimum text and presented via pop up boxes while the user mouse over conceptual words. This is done to minimize a user's mental effort. The user is then familiarized with the lesson interface explaining what to anticipate, what a user is allowed and not allowed to do during the experiment. During the lesson (trials and sections) the user is guided by pop-up text prompts telling the user to go to next lesson, trial or when done with the last trial 3, section3[5] to proceed to Quiz.

Using a real-world (Mandel. 1997) digital camcorder metaphor, the screen used a jpeg DVCAM photo (Fig. 1) which served three purposes: as background for the content area (DVCAM) ; as context that acquainted users on the location of the parts and control dials and, as a bounding box that held all icon, text and movie information. This background appeared throughout the Lesson only. For text, the location, size, color and type of font (Ross 1988) stayed the same for different types of information. For example, the font type (AGaramond), color and size and location for the 'Step Number' button stayed the same throughout the lesson. The same rule applies to the heading and prompts. The importance of the text information determined the size of font, i.e. words such as 'Lesson, Camera, Program, VCR and Quiz' needed to be emphasized and had to use (font size 14) than the heading text (font size 12). The icon images were of the same size and location with a buttonized, raised 3-D look. Predictability was solved by using a consistent design of having the icon in the upper left corner, step number on top of the icon, text meaning below the icon and process meaning in motion video on the right of the icon. This arrangement made it easy to locate information minimizing confusion and getting lost on the interface. Textual prompts appeared whenever a section, trial or lesson was concluded, guiding the on what to do and where to click next. The objects on the interface such as the icon, the text explanation and the movie file, which appeared after the icon was invoked, are grouped[6] within a 3.5" radius. I maintained the same radius for presenting single-answer multiple-choice question. I used a bigger 4.5" radius for the several answer multiple-choice questions. This avoided the information seeking behavior of the eyes to move around the interface when trying to locate information (Tullis, 1997). This kind of perceptual grouping[7] encouraged to make meaningful associations among the presented information (Winn 1993). Overall, the interface had a simple, uncluttered look.

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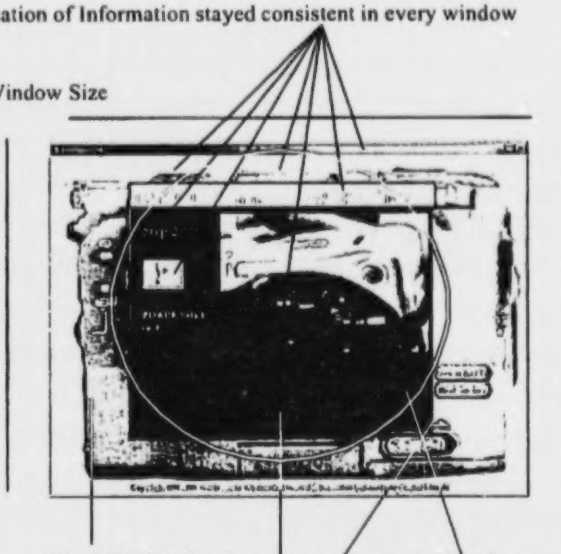
[4] Experiment began Spring Semester 2000 and concluded Spring 2001 at the University of Central Florida, Orlando, Florida on UCF Graduate Student Volunteers.

[5] The last part of the lesson

[6] Close Proximity concept – information is processed faster and understood better when located close to one another

Location of Information stayed consistent in every window

800 X 600 Window Size



The DVCAM image serves as a contextual background throughout the lesson. Screen color used was black which contrast and made the icons stand out.

Buttons and active links appeared only when needed and prompts appeared only at appropriate times

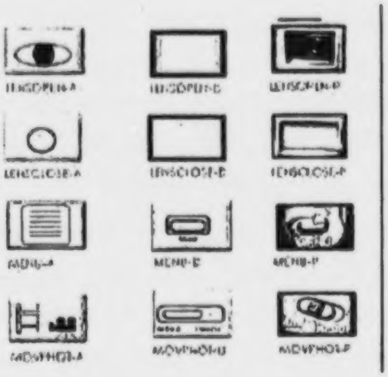


Fig. 2 Screen Capture of the Lesson Interface (not to scale)

Fig. 1 Buttonized Images

The Tools

The Lesson was divided into three sections. One section presented the sequential steps to set the Canon ZR digital video DV camcorder DVCAM to CAMERA mode. Once in that mode, the DVCAM can be set up in various ways[8] which will have an effect on the recorded output. For illustrative purposes and to show the basic difference between digital video recording in contrast to standard analog video recording, the option of setting the DVCAM to DIGITAL EFFECTS for the Camera Menu was chosen. The steps lead to finally setting the DVCAM to Digital Effects thereafter showing the different effects one can use for a project. Of the seven[9] built-in digital effects, only four, Fade-Trigger, Art. Sepia and Strobe were used. Another section presented the sequence of steps to set the

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[7] Perceptual Grouping – Buttons, objects such as a group of menu buttons, in this case, group of information that relates to the icon being grouped together are meaningfully associated with one another.

[8] Camera Menu options are: Shutter Speed, Digital Effects, Image Stabilizer, Digital Zoom, 16:9, White Balance; Self-Timer; Remote Sensor; Recording Mode; Audio Mode; Wind Screen; Backlight; Brightness, Date and Time set.

[9] Fade Trigger-At Start, the scene gradually fades in from a black screen. When stopped, it gradually fades out; Wipe-At Start, the picture begins as a thin vertical line in the center of the screen gradually expanding sideways to fill up the whole screen. At Stop, the image is wiped from both sides of the screen; Scroll- At Start the picture appears from the right hand side of screen expanding sideways to fill up the whole screen. At Stop, the image is wiped off. Art- Adds a paint-like solarization effect to the image. Black and White-Records the image in black and White; Sepia-records a monochrome image with a sepia tint; Strobe-On-screen actions become a series of still images i.e. slow motion effect.

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DVCAM to PROGRAM Mode. In this mode, six options[10] are available to suit the recording environment. For illustrative purposes the LOW LIGHT option was selected. When set to Low Light, the DVCAM can record in dimly-lit places. The other section presented the sequence of steps for setting the DVCAM to VCR mode. When in the VCR mode, a user can view the recorded product.

Each step is represented in three different icon design. For that reason, MS Image Composer and JASC PaintshopPro[11] were used. Image Composer was useful for minimum photographic image enhancements such as cropping, erasing, sharpening, blurring and texturizing. PainshopPro, another image editing software's, Drawing Tool, not only allowed freehand drawing of shapes, geometric shapes, vector arrows etc. but also allowed enhancing of graphic objects. Through its Image and Effects Menu, I was able to fill shapes e.g. arrows with colors, rotate the f vectors and enhanced their brightness and illumination. The last feature was particularly useful in enhancing the photographic-pictorial symbols resulting in a sharper, clearer image. When all the graphical digital assets were completed, each one was given a uniform dimension and applied a Buttonize effect giving it a raised clickable 3-D look (Fig 2). Video files were created by first recording the different steps in analog format. Using a software converter called DAZZLE, these analog files were converted into MPEG files. Once captured and saved onto the PC's hard drive, these MPEG files were enhanced, edited and cut. When set in Snap Capture and View mode, these same MPEG files were used to extract JPEG images as well. To create the entire multimedia program, Macromedia Authorware Attain 5 was used. Authorware is an object-oriented, multi-platform authoring tool which recognizes various file formats for animation, audio, video, text and graphics. Knowledge Objects are mini programs that can be added to the main authorware application. In Authorware there is a Quiz Knowledge Object, an Application Knowledge Object, a Movie Controller Knowledge Object etc. Its Knowledge Objects Application shell was used to develop the LOGIN portion which is where the user inputted personal information such as name (first, last and middle) and subject number. The rest of the multimedia measuring instrument program was completed using the flowchart, icon-based authoring approach.

Once operational Camtasia, a screen recording software was used to track user's actions . Time and scores on the quiz were captured on the hard drive. These MPEG files dynamically recorded all user actions in real-time which can be replayed and reviewed. User's behavior on the program such as movement of the cursor appearing as an arrow or a hand can be observed and counted during replay.

Conclusion

The behavioral and cognitive design principles that guided the creation of the multimedia measuring instrument can be used for similar learning, performance and evaluation exercise for different content areas in interactive simulations, CD or web-based training and other technology-related training. The tools I used for creating the instrument are but a few of the many applications available. It is now common practice to download trial versions of software[12] for 30-45 functional days. After the elapsed period, these downloaded applications will stop working and will prompt the evaluators to purchase the product. Much of my instructional technology application try outs are done this way.

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[10] Auto

[11] Evaluation version downloadable at www.jascpaintshoppro.com

[12] www.macromedia.com www.jascpaintshoppro.com www.techsmith.com

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Fulfilling the Promise of Electronic Portfolios

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Abstract

Electronic portfolios have great potential for promoting reflective independent learning at all grade levels, from elementary school to graduate teacher training. Developing an electronic portfolio, however, involves mastering both the complexities of designing and developing portfolios and the complexities of designing and developing multimedia and/or World Wide Web materials. This paper presents strategies for efficiently, effectively, and economically carrying out the multiple processes involved in electronic portfolios, emphasizing strategies that work in real-world settings.

Fulfilling the Promise of Electronic Portfolios

Assessment is the "glue" that holds together planning and instruction. A growing trend in educational assessment is the attempt to develop and use more authentic, performance-based assessment procedures and tools. Authentic assessments provide students the opportunity to demonstrate, rather than tell or be questioned about, what they know. The use of portfolios to assess student learning is an approach to authentic assessment that is increasing in popularity at all levels of education, from elementary school (e.g., Fogarty, 1996) through graduate teacher training (e.g., Krause, 1996).

The Portfolio Process

Portfolios are more than a collection of artifacts; they are "a systematic and organized collection of evidence used by the teacher and the student to monitor growth of the student's knowledge, skills, and attitudes." (Vavrus, 1990, p. 48). Portfolios enable students to become more aware of themselves as learners and to take ownership in the processes and outcomes of their own learning.

Danielson and Abrutyn (1997) identified four basic steps in the portfolio development process. Portfolio development begins with the *collection* process. Students assemble work samples and other materials that demonstrate the processes and products of their learning, based on the purpose of the portfolio. The next step is *selection*, in which the student selects examples of his or her best work (for a product portfolio) or work that exemplifies specific criteria (for a process portfolio). Students should select sufficient materials to demonstrate the full range of their learning.

A third (and key) step in the portfolio development process is *reflection*. Students analyze each item they include in their portfolio to identify ways in which developing or collecting the item contributed to their learning. The reflective process is a tool for the analysis of learning and self-growth. In reflecting on each item in their portfolio students go beyond summaries to analyze and synthesize their knowledge, skills, and attitudes as they develop. Students who are new to portfolios will need considerable guidance and practice in order to develop the ability to engage in insightful, higher-order reflective thinking. Reflections can be categorized as: (1) *reflection-on-action* (looking back and reviewing what was done); (2) *reflection-in-action* (reflecting while in the act of carrying out a task); and (3) *reflection-for-action* (reviewing what was done and identifying future actions and improvements) (Killian and Todnem, 1991).

The final step in the portfolio process is *projection*, in which students look ahead to where their learning will take them. They set goals for the future, and examine their past work in order to identify patterns, strengths, and weaknesses.

The Potential Role of Technology in the Portfolio Process

Traditional portfolios are print-based. However, as new and more powerful technologies become a regular part of learning and instruction, more and more teachers and teacher educators are seeking ways to use various technologies to create electronic portfolios (Barron, (2000); Venezky (1998)). Electronic portfolios have several potential advantages over traditional portfolios, and they validate the use of technology as an essential part of learning and instruction for both students and teachers: "Releasing the power of technology in the classroom via portfolios enables the teacher to reach more students effectively and efficiently, while engaging them in a more realistically meaningful process of learning." (Cole, Ryan, Kick, and Mathies, 2000, p. 50).

Electronic Portfolios: Challenges and Opportunities

The increased effectiveness and efficiency of electronic portfolios comes at a price. The electronic portfolio process includes all of the complexities of the traditional portfolio process (collection, selection, reflection, and projection). Added to these are the additional complexities associated with designing, developing, and managing electronic (digital) information. Ivers and Barron (1998) have identified five stages in the development of multimedia materials: (1) Decide/assess (determining the goals, audience, and the needs of the audience); (2) Design/plan (identify content and sequence of presentation); (3) Develop (collect and/or generate components; (4) Implement (present the multimedia materials); and (5) Evaluate (measure and judge the effectiveness of the multimedia materials). If the multimedia materials are web-based, an additional layer of complexity is added related to publishing the materials on the World Wide Web (dealing with network protocols, moving and managing information among several different computers, etc.). Both the portfolio development process and the technology design/development process must be carefully coordinated in order to achieve the stated goals of the portfolio process.

Electronic portfolios range in complexity from a floppy disk of word processor files to full-featured World Wide Web sites with extensive multimedia information and interactive capabilities. There is a rather steep learning curve for both teachers and students in becoming adept at developing, using, and managing electronic portfolios. Not all students and teachers will have the knowledge and skills required to use every type of technology they might want to incorporate into their electronic portfolios.

Electronic Portfolios: Strategies for Effective and Efficient Use

Should developing multimedia and World Wide Web design and development expertise be considered part of the portfolio development process or as a separate task? Is there time in the school day to learn new technological tools while at the same time learning about and implementing the complex portfolio process? The strategies presented in the following sections demonstrate the interrelationship between the dual processes of portfolio development and digital media development, and illustrate potential ways to make the development of electronic portfolios a more efficient, effective, and (it is hoped) cost-effective process.

Using Technology to Support and Enhance the Collection Process

Word processor, spreadsheet, and/or database software can be used as appropriate both to generate and to collect artifacts for the portfolio. It is likely that many of the artifacts to be incorporated into the portfolio already exist as digital files; collecting them as digital information is a logical alternative to producing print versions of the information and trying to organize the large amount of paper typically produced for a portfolio.

Charts, drawings, photos, and other non-print documents can be scanned and converted to appropriate digital form. Digital cameras (still cameras and/or camcorders) can be used to document events and processes in a form that is much more difficult (if not impossible) using traditional portfolio formats. The use of technologies, therefore, enhances not only the depth but also the breadth of the portfolio contents while making it easier to produce and collect relevant information for the portfolio.

Using Technology to Support and Enhance the Reflective Process

The reflective process is very complex. Technology can support the analysis of learning and self-growth involved in the reflective process is several ways. Even a relatively low-level technology such as a word processor can make recording and organizing reflective statements more efficient. Date and update information can be included in the name of the word processor files, so that the files will be arranged chronologically when automatically sorted by name.

Initially reflective statements can be added to a word processor file as the reflections occur to the student. After reviewing all of the reflective statements, the student can use the outline feature of the word processor to organize and sequent the collection of reflective statements. The various reflective statements can be organized by theme and sub-theme using different levels of headings. Students who have a higher level of proficiency in technology (for example, students proficient in HTML or web authoring tools) can organize their reflective statements as an interrelated set of web pages. Using web technology make possible the organization of reflective statements in a multi-linked, hypertext format to express multiple interrelationships among reflective statements.

Using Technology to Support and Enhance Collaborative Activities

Portfolios have a dual purpose. They provide a vehicle for self-reflection to guide the student's future learning. In addition, they provide a vehicle to document and to communicate of the student's accomplishments. Technology, especially network technologies, can enhance the collaborative aspects of portfolio development in several ways. Word processor documents and/or web pages that initially were used to collect all possible reflective statements can be edited as part of the selection process of portfolio development. Electronic mail can be used to communicate with co-learners and the teacher, particularly when the communications are the one-to-one type. Co-learners can use the "track changes" feature included in most word processors to embed peer review comments in the student's original file and return the annotated file to the original author.

Presentation technologies such as PowerPoint can be used to develop a summary document that presents the major components, analyses, and reflections contained in the full portfolio. Online discussion groups facilitate distribution of information from the teacher and the sharing of information and resources among students. Students can publish drafts of their portfolios on a web site (either as part of a WebCT or Blackboard course site or on a site developed specifically to support the portfolio process) to facilitate peer review of their portfolios.

Using Technology to Support Portfolio Assessment and Presentation

The same technologies that support peer review and communication can be used by the teacher to provide individualized feedback during the portfolio development process and for assessment of the final version of the portfolio. Teacher comments and suggestions can be directed confidentially to an individual student via e-mail or through a discussion group, or the teacher can use a discussion group to broadcast comments, clarifications, and suggestions that arose in the context of interacting with an individual student to the entire group of students. Comments can be sent to the student via e-mail. Teachers can use the "track changes" feature included in most word processors to return an annotated version of documents with the teacher's comments embedded at appropriate places in the student's original documents.

The use of appropriate technologies also facilitates the teacher's assessment of the final versions of the portfolios. Students can submit the final versions of their portfolios as a folder of files (in Zip form if the files are large) that can be sent to the teacher as an attachment to an email message. If all students are proficient in developing and publishing web materials, students can publish their portfolios on a designated web site. The instructor can then develop (or commission) an "overview/directory" page with links to each student's portfolio.

If students submit their portfolios in digital form (e.g., as a folder containing all of the files that comprise the portfolio contents or as a web page), all of the portfolios to be evaluated can be stored in one place, either on an individual computer or an a web site. This will facilitate both individual assessment and comparison of various students' portfolios.

These same technologies (PowerPoint, web pages, etc.) that students used to develop working drafts of their portfolios can be used to present and distribute the final versions of their portfolios. These technologies make it possible for individuals (a student, a parent, a teacher, a prospective employer of a pre-service teacher) to view the complete portfolio. It is also much easier for a teacher to preserve samples of exemplary portfolios to be used as guidelines for students in future classes.

Students who have the requisite technology skills can transfer their complete portfolio to a CD-ROM for archiving and distribution. Certainly being able to give a prospective employer a CD-ROM provides definite advantages over giving him or her a large bulky binder.

Using Technology to Support the Portfolio Process: Questions and Cautions

The major question to be answered in deciding whether and/or how to implement electronic portfolios is: What is the appropriate use of technology in the portfolio process? In answering this question, one must address (a) the purpose of portfolios in a particular learning situation; (b) the skills and knowledge of the students, both in the area of portfolio development and in the use of various technologies; and (c) the audience for the portfolios (including both immediate and potential long-term audiences).

Several specific questions must be addressed in planning for the use of electronic portfolios and in deciding the extent to which electronic portfolios can be used in a "real-world" situation with a given group of students. These questions include:

What level of technology knowledge and skills do students begin with?

How will students develop additional technology knowledge and skills if they are needed?

What resources (equipment, software, technical support, materials, time) are available to support the development of electronic portfolios?

In answering all of the above questions, and in every phase of the design and development of a technology-based/technology-facilitated portfolio program, the major principle to keep in mind is that learning and the needs of learners should determine which technologies are used and how they are used. Technology should be an enabler, not a driver, of the process. It is hoped that this paper will provide guidance and support to educators already engaged in or considering the use of electronic portfolios.

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Designing Digital Instructional Management To Optimize Early Education

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Abstract

Next to playing, matching instructional features with children's characteristics may stimulate children's development in early education. Instructional lines of ordered playing and learning appliances, inclusion of diagnostic and achievement indicators, flexible grouping of students, screening of initial student characteristics, and supportive software, are expected to optimize early education for students and teachers. In two Dutch kindergarten schools, instructional changes were realized in a use-oriented method by co-development with teachers and management. Also, a software prototype designed to manage and optimize early education was developed and tested. Information is given about the digital instructional management prototype, development and implementation experiences in early education, and first effects of using this software in practice. Further possibilities to optimize education in kindergarten and other educational types are discussed.

Learning and instructional theories focus on individual or small-group learning, although, in school practice, learning usually occurs in the whole group or class (Collier, 1994). Within a whole group, class level learning expectancies, complexities, and norms may then interfere with small-group and individual learning possibilities and potentials. This is true in particular for learners who seem to be at risk in some respect, e.g. a learner functioning relatively low compared to most other learners (Walker, Kavanagh, Stiller, Golly, Severson, & Feil, 1998), or relatively high as specified by e.g. King, O'Shea, Joy Patyk, Popp, Runions, Shearer, and Hendren (1985).

To support development and learning processes and effects, each student's characteristics should be matched with actual instructional and didactic features (Van Merriënboer, 1997). A learner 'deviating' from the other learners may therefore profit most from instructional management designs which optimize teaching and learning for all students actually present in class. However, giving more attention to more details of learning processes requires much, and often too much, of the teacher. As differences in development and learning between children can already be rather huge at the start of kindergarten, providing adequate instruction and prevention of learning de-motivation and problems may become too complicated for the teacher (Jones, Gullo, Burton-Maxwell, & Stoiber, 1998). In this respect, Information and Communication Technology (ICT) can lend a hand (Chang, 2001; Sinko & Lehtinen, 1999). ICT consists of different kinds of electronic hardware and software which, in combination, may support the preparation, execution, and evaluation of networked teaching and learning processes and effects (Lally, 2000).

In research to explore the role of ICT in optimizing instructional and didactic management, qualitative research to model didactic and learning processes was carried out in ten Dutch secondary schools varying in background characteristics (Mooij & Smeets, 2001). Five successive phases and respective models of ICT implementation were found:

1. Incidental and isolated use of ICT by one or more teachers
2. Increasing awareness of ICT relevance for the school, at all levels
3. Emphasis on ICT coordination and hardware within school
4. Emphasis on instructional and didactic innovation and ICT support
5. Use of ICT-integrated teaching and learning, independent of time and place

After acquisition of hardware and software in phase 3, in phase 4 ICT is designed to support learning processes in more flexible and optimizing ways. In phase 5, education is being restructured from the perspectives of the learners. This process requires transformation of teaching and learning processes by changing instructional features and didactic management, in close relationship to ICT conditions supporting both individualized and small-group learning in and outside school.

Optimizing education since the start of kindergarten may be the most promising effort to prevent de-motivation and learning problems (cf. Walker et al., 1998). Therefore, the question for research is how model 5 could be designed and implemented in early education to realize the advantages potentially related to this model, in particular for students at risk. To answer this question, I will first focus on theoretically relevant instructional and management conditions to support students since the start of kindergarten (cf. Van den Akker, 1999). Next, in co-development with teachers and management, some required educational changes are realized in kindergarten practice. Then, relevant software is implemented and the user effects of this first prototype are revealed and evaluated.

Theory

Bergqvist and Säljö (1998) report about grades 1–3 of four elementary schools in Sweden. The schools use an individualized curriculum in an age-integrated classroom and the students are aged seven to nine. The researchers concentrated on student and teacher cooperation in discussing the student's weekly planning and working or, in other terms, about learning to self-regulate the schoolwork. Their observations reveal that many responsibilities are conveyed from the teacher to the student because social, pedagogical, and learning roles are intricately related to the instructional, didactic, and school-wide curriculum organization of both teaching and learning. Moreover, a student is functioning better if he or she is able to choose playing or instructional activities according to or slightly above his or her actual level of competency within a certain field. Comparable results are found by the American research of Jewett, Tertell, King-Taylor, Parker, Tertell, & Orr (1998) who concentrate on pedagogical and curricular aspects teachers have to realize to help children with special needs in kindergarten. If this matching is not realized, motivation and achievement problems may turn up for students functioning at relatively lower or higher levels of competency than their peers.

Theoretically, curricular features should be designed in such a way that concrete instructional and didactic processes are supporting each learner's activities at any time, in a positive social context. Learning could be designed also for a small group of students helping each other, or collaborating with one other (Jones, Rasmussen, & Moffitt, 1997). In this situation, the teacher's attention can concentrate more on students who most need his or her attention. Such an instructional design would require flexible instructional lines with clear diagnostics next to situations of free playing, including flexible grouping and organization throughout the educational career. On the student's side, it should be clear which competencies, and which initial levels of competencies, should be stimulated in which ways, to optimize developmental progress since the start in kindergarten.

Free Playing And Instructional Lines

In early education, free playing activities are usually based on children's own initiatives and choices (Pellegrini & Boyd, 1993). The concept of 'instructional line' can be used to refer to a specific set of learning activities ordered according to instructional difficulty level or social didactic aspects, e.g. motor behavior, social-emotional development, projects, language and literacy, (preliminary) arithmetic, (preliminary) reading, and (preliminary) writing. The line concept denotes a hierarchical arrangement of curricular concepts and sub-concepts corresponding with specific instructional or didactic play materials, representing specific learning or play activities. For example, sensorimotor development for four- to six-year-olds generally starts with global movement with the whole body, followed by movement with the arms and hands, and then by paying attention to writing conditions, e.g. direction in moving, training of regularity in movement with hands and fingers, and motor exercises evolving into preliminary writing.

Diagnostic And Progress Indicators

Within instructional lines, reliable and valid indicators need to be integrated to diagnose and evaluate learning processes and their outcomes on every student, from the start in kindergarten onwards. Monitoring is important, in particular to realize a timely promotion of the development of children at risk. Also, a standardized diagnostic or age-normed achievement test should be included. Each student's progress can then be evaluated continuously by individual, social, and age-normed diagnostic and achievement tests in the architecture of lines (cf. Byrne, 1998; Wegerif, Mercer, & Dawes, 1998).

Flexible Grouping And Organization

Making the organizational grouping of students more flexible according to learners' characteristics and instructional procedures seems another precondition to promote school careers of students at risk in particular (Bennathan & Coxall, 1998; Cooper & Ideus, 1998). Flexible grouping in small groups can for example be designed on the basis of students' competency levels, learning style, or specific didactic preferences or requirements in case of certain handicaps. Moreover, flexibilizing of students' grouping can also stimulate cooperation between professionals in and outside school, to support children better than in their earlier development (Mangione & Speth, 1998).

Screening Of Children's Entry Characteristics

Close observation and analysis of interactions between instructional features and students' learning characteristics reveal that development and learning problems may start early in kindergarten (Skinner, Bryant, Coffman, & Campbell, 1998). Given the differences in development between children already at the very start of kindergarten, it is important to present adequate and diverse kinds of playing and learning materials. This is most relevant for children deviating most from the other children in class. To get relevant information as soon as possible, it is helpful to screen a child's starting characteristics by parents at intake, and by the class teacher after the child's first month in school. Communication about differences between the perceptions of parents and kindergarten, and taking adequate curricular action if indicated, can prevent motivational, social, emotional, or cognitive problems of vulnerable students in particular. The teacher or another professional can additionally diagnose or assess characteristics, and assign specific playing and instructional activities to a child or a small group of children, if possible in cooperation with parents. Guidelines to this optimization process are presented and discussed by Mooij, Terwel, and Huber (2000).

Software Features

Initially, it is not clear how software could be designed to support the optimization possibilities sketched above. For this reason, it was decided to first start the developments sketched above in kindergarten practice. In doing this, it could be checked in how far design features of the software could be based upon educational features, and how their specifics had to be to help teachers. At the same time, implementation and first effects of the software could be observed.

Method

The theoretically desirable educational features were not known to exist in practice. Therefore, a developmental project was planned in two regular Dutch kindergartens for children aged four to six. The usual planning system in these kindergartens consisted of a planning board on the wall, with a differently colored column for each day of the week. Small groups of students, corresponding with certain table groups, were indicated by different logos and colors. Activities to be done by a small group were assigned by placing the tags of these students on a logo representing a certain kind of activity, on a certain day of the week, on the planning board.

In the years 1997–2000, teachers, management, and the researcher collaborated to develop instructional lines based on the regular playing and learning appliances in the kindergarten classes. Recent methodology supports a strategy in which users, for example teachers and school staff, collaborate with researchers and other specialists to secure validity of innovation processes (cf. Blumenfeld, Fishman, Krajcik, Marx, & Soloway, 2000; Clark & Estes, 1999; Kensing, Simonsen, & Bødker, 1998). Wilson (1999) expects that 'use-oriented' strategies '(...) increase the likelihood of successful implementation because they take the end use into account at the beginning design stages' (p. 13). This development co-occurred with flexibilization of grouping of students, and the screening of students' entry characteristics by parents and the class teacher.

In the first period, attention was focused on rearranging and registering the appliances to clarify the instructional and didactic aspects of the playing and curriculum system. Next, the use of the registered appliances either by the teacher or by self-management of the students was made concrete. Parallel to this, and in the same collaborative way (cf. Ely, 1999), a first prototype of a computer program was designed and developed. The design concentrated on extending optimization features and possibilities of the planning board, to better assist teachers and students (Crook, 1998). Essential software functions of this 'digital instructional management' were related to registering and manipulating information about instructional lines, students and teachers, and promoting students' instructional self-management. The information from educational practice was collected into digital databases within the framework of a standalone computer.

Results

Software Features

Information on Instructional Lines. A first main feature of the prototype is the creation, change, or removal of an instructional line. Lines developed refer to, for example, motor behavior, social-emotional development, projects, language, (preliminary) arithmetic, (preliminary) reading, and (preliminary) writing. Each instructional line in kindergarten class and, correspondingly, in the software, is characterized by a specific logo, a specific color, and a corresponding name or text. Activities or tasks within each line are visually represented by a photograph of the object as present in class because four-year-olds must be able to work with the program. A screenshot of this feature of the prototype is given in Figure 1.

A second main feature concerns the input, change, or removal of activities or tasks within specific levels of an instructional line. Within a line, activities or tasks are ordered by difficulty level. To stimulate students adequately, variants of lines referring to different developmental levels were constructed for e.g. 'normal' students developing in a more or less regular way, students requiring special or remedial activities, and highly able students who are advanced on the topic of the line. Moreover, an activity can be tagged with an indicator meaning that the student has to go to the teacher in order to continue. For example, an indicator may mean that a student's initial level of language competency has to be screened, as a basis for further support and placements. In the same vein, a standardized diagnostic or achievement test can be included, in particular for measurement with a conspicuous student or a student at risk. Another potential use is the formation of a small group of students by the teacher, to do the tagged activity. A screenshot of ordering an activity by using a photograph, name, and description into an instructional language line at level 6 is shown in Figure 2.

Figure 1. Symbols (Logo, Color, Name Of Line) Representing Four Instructional Lines

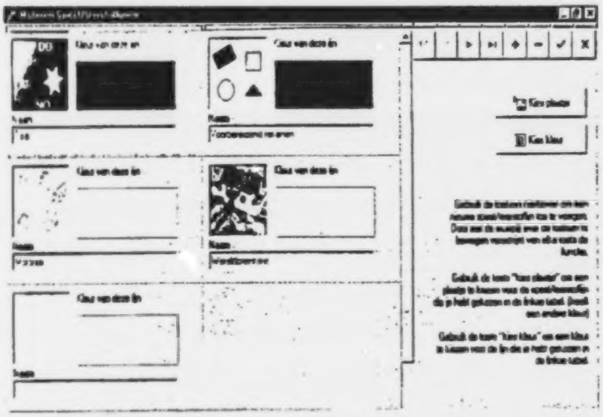
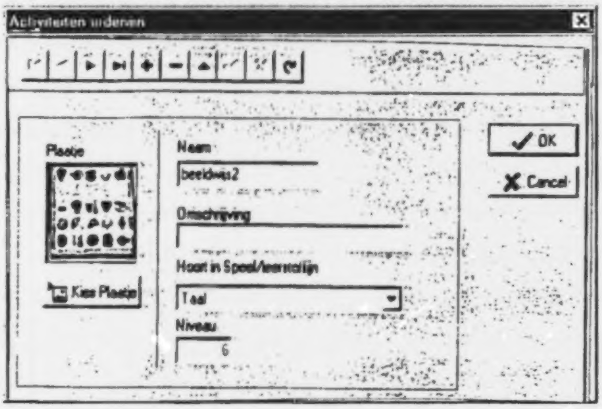


Figure 2. Ordering Of Activity (Photograph, Name, Description) Into Instructional Line And Level



Naam: beeldwas2

Omschrijving:

Hoort in Spel/leerstoflijn: Taal

Niveau: 6

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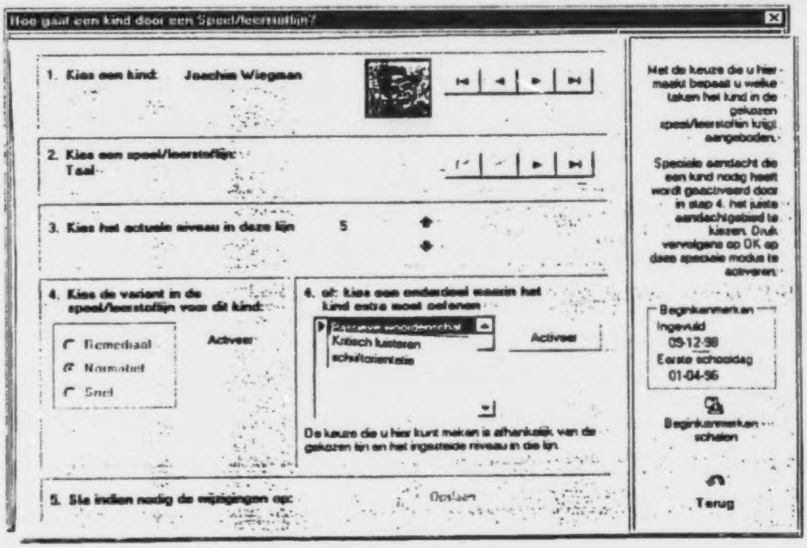
A third feature of the software is the possibility to get an overview of the content of an instructional line, or a set of variants of an instructional line, at a specific level of difficulty.

Information about Students. Another main feature of the software has to do with registering administrative information about a student: adding a new student, removing a student, or changing existing information about a student. For example, the teacher can register students by integrating their photographs in the database. The photographs of all children in one class can be shown in one screen. Furthermore, the registering of each student's initial characteristics is carried out in conformance with a psychometrically controlled procedure based on quantitative longitudinal research with 966 four-year-olds (Mooij, 2000). An overview of initial characteristics of a student, and a comparison between the information from parents and teacher, can be produced automatically.

A second main feature here is placing a student within an instructional line. Teachers can insert and order pictures of didactic activities or materials, and assign different activities to different students. A screenshot of these possibilities is given in Figure 3. This figure shows that a teacher can successively select a child (see Program Line 1 with the photograph of the student), select a kind of instructional line (2), the actual difficulty level of this line (3), the variant of the line for the student (remedial, regular, fast, or some specific material: see 4), and finish by saving the changes made (5). The next time this boy accesses the computer software, his choices to play or work are determined by the teacher's instructional management decisions. In this way, the student's choices and consequent activities are regulated by the digital instructional management system. It should be noted that the student is not working on the computer to complete activities, though teachers can of course decide to include this possibility as one of the alternative instructional lines.

Figure 3. Placing A Student Into An Instructional Line, With Level And Other Specifics



Hoe gaat een kind door een Speel/leerstoflijn?

1. Kies een kind: Joachim Wiegman

2. Kies een speel/leerstoflijn: Taal

3. Kies het actuele niveau in deze lijn 5

4. Kies de variant in de speel/leerstoflijn voor dit kind:
○ Remediaal
● Normaal
○ Snel

4. of: kies een onderdeel waarin het kind extra moet oefenen
Passieve woordenschat
Kritisch luisteren
schriftoriëntatie

De keuze die u hier kunt maken is afhankelijk van de gekozen lijn en het ingestelde niveau in die lijn.

5. Sla indien nodig de wijzigingen op:

Met de keuze die u hier maakt bepaalt u welke taken het kind in de gekozen speel/leerstoflijn krijgt aangeboden.

Speciale aandacht die een kind nodig heeft wordt geactiveerd door in stap 4. het juiste aandachtsgebied te kiezen. Druk vervolgens op OK op deze speciale modus te activeren.

Beginkenmerken
Ingevuld
09-12-98
Eerste schooldag
01-04-96

Third, the software allows automatic logging of activities for each of the students working with the software.

Information about Teachers. Here the most important facilities refer to adding a new teacher to a specific class, removing a teacher, and changing existing information about a teacher.

Students' Instructional Self-Management. A student can click his or her own photograph on the screen that contains all the photographs of the students in class. What the computer screen then looks like is shown in Figure 4. The screen shows the photograph and the name of the student (top-right corner). The top–left corner presents the object or material that the student is actually working on. The three icons at the bottom of Figure 4 each illustrate one possibility: the student is ready and wants to stop with this task (left icon), the student wants to select a new activity (middle icon), and the student made a wrong choice and goes back one decision (right icon). Using this interface, the student has to know which virtual assignment corresponds with which real playing or instructional activity in the classroom. Of course, a student can be helped by another student or by the teacher.

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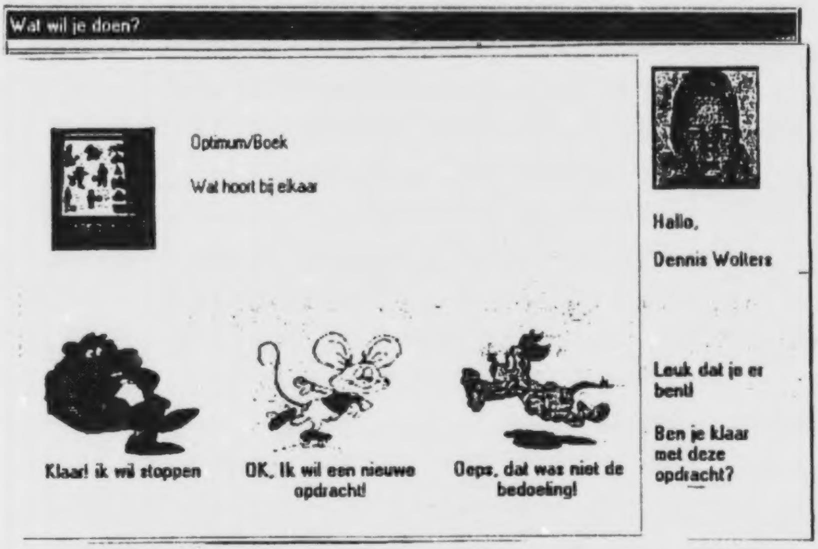
Children usually play or work with the real three-dimensional materials, and not on the computer. This feature seems to suit children of this age best, and it also overcomes computer access constraints. Moreover, a teacher can change or extend playing or other structured activities within a line, to improve the educational processes or to check their desired effects on one or more students.

Functioning Of The Prototype

Implementation and Effects in Kindergarten Practice. First of all, by using the prototype the teachers discovered that their playing and learning activities and materials needed acute extension. This insight was based on the screening of the students' initial competencies by the parents and the class teacher, and the subsequent need to integrate the different levels of initial competence into adequately differentiating playing situations and instructional lines. The differences between their students were much bigger than was accounted for in the available activities, appliances, and materials. A clear consequence was that a great deal of the school budget was spent on buying new playing and learning materials.

Figure 4. Screen Showing The Alternatives Reflecting A Student's Self-Management



Wat wil je doen?

Optimum/Boek

Wat hoort bij elkaar

Hallo,

Dennis Wolters

Leuk dat je er bent!

Ben je klaar met deze opdracht?

Klaar! ik wil stoppen

OK, Ik wil een nieuwe opdracht!

Oeps, dat was niet de bedoeling!

Second, teachers learned pedagogically and instructionally relevant relationships between the characteristics and activities of the children, and the use of playing and learning materials and appliances in kindergarten. According to the teachers, this enabled them to use the materials to promote the functioning of the students much better than before. However, teachers took much more time than before to instruct the students. Since the class size (25–30 students) imposed severe time restrictions, the time problem was resolved by calling in parents to instruct specific students. This was not really satisfying. Much more teacher assistance seems needed to adequately integrate student differences present at the start of kindergarten. The software thus highlights that there may be more work than only one teacher in a class can handle.

Third, some of the students of four, five, or six years old learned to get along with the program very soon. They could assist other students too, if necessary. Some of the students had more difficulty in using the program. Because students' self-management was clearly stimulated by the software, the teacher's opportunity to devote more time to the students who needed this assistance most, was enlarged.

Finally, a main experience of all persons involved in the development was that the co-development of curriculum, learning, and ICT conditions in practice started a learning process for all (cf. Remillard, 2000). The collaboration between teachers, management, research, and software developers, according to a use-oriented design, proved to be very worthwhile.

Potential to Optimize Instructional Management. The first prototype in kindergarten suggests more possibilities of software to optimize instructional and didactic management processes. Instructional lines can function as main vehicles to explicitly define, integrate, and evaluate curricular features and processes, diagnostics and specific assessments, and learning processes, at different educational levels simultaneously. In addition to ordering and presenting instructional lines, ICT can help to diagnose and assess each student's progress in both individual and group-normed ways, and to construct specific instructional lines for marginal students or students at risk, if necessary in collaboration with external specialists. ICT can also support networked instructional and didactic management for various types of users at different levels of the educational system, e.g. students, teachers, school administration and school management, and external professionalists (see e.g. Tymms, Merrell, & Henderson, 2000). An explorative overview of relevant levels, potential users, and optimization functions of ICT, is given in Table 1.

Table 1. Optimization Functions Of ICT At Various User Levels

Users / High-Low Educational Levels	*Optimizing Functional Features of ICT*
Policy / Development / Research	Collect and evaluate data from (interactions between) curriculum and learning at all levels. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning.
Regional Instances (e.g. School Psychologists, Advisors, Youth Aid, Municipal Policy)	Aggregation of in-school data to data at regional level and regional developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop and evaluate qualitiesof regional features relevant to curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk. Collaborate with school / location management, teachers, students, and parents.
School Board, Management, Staff	Analysis of curriculum / learning data re. unit / location / school level and developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk.
Teachers	Analysis of curriculum / learning data re. student / (small-) group level and developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk. Complete / change / output indicators re. level-specific curriculum and student characteristics. Complete / change / output indicators re. instructional lines and groupings for student(s). Complete / change / output (normed) indicators on individual and group achievement.
Parents	Completion of initial and other competencies of their own child. Overview of their child's developments and progress ('virtual portfolio').
Students / Learners	Automatic logging and storing of activities chosen, and logging of processes and results. Select actual or next instructional line, and actual or next activity. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning.

Integration of Diagnostic and Achievement Evaluation. The evaluation of the prototype also suggests the specification of three kinds of activities within an instructional line: regular activities, evaluative activities, and normed activities. Normed diagnostic and achievement indicators in instructional lines are defined as representing a generally valid kernel structure of pedagogical-didactic features of the curriculum. This kernel allows a structured diagnostic evaluation of a child's characteristics and progress in individual, social or group, and normed respects, in the course of time. Such a multidimensional evaluation scheme is needed to provide a complete responsible stimulation of the development of a child, from the start in kindergarten onwards. Moreover, the kernel structure can be changed locally or extended into local instructional lines which better fit situational teaching or learning conditions, as long as the normed referents in the lines are kept intact. The same or comparable indicators can be used as a common frame of reference for the preventive commitment of external specialists like a school psychologist (cf. Griffin & Beagles, 2000).

Discussion

In a four-year project, attention was focused on the improvement of early educational practice in kindergarten. To this end, instructional lines with respect to ordinary playing and learning appliances were co-developed with teachers and management. Ordering of instructional, didactic, and diagnostic materials occurred with symbols (logo, color, names) to make them concrete for young children. Also, software was developed and used in two classrooms to check their functioning in educational practice.

The results can be summarized as follows. First, starting characteristics of each student are measured and discussed systematically by parents and teacher. Problems or risk characteristics can get more systematic and preventive pedagogical attention, if necessary by early inclusion of specialists outside school. This means that preventive cooperation between parents and kindergarten teachers can increase considerably in comparison with current practice in early education.

Second, next to the usual free-playing and whole-group sessions, each student can now get systematic and immediate curricular support at his or her own levels of competency. Controlled specific support can become available for the students who need this. Also, automatic logging and monitoring of student and class or school results becomes available, which is not dependent on only one teacher or small group of teachers.

Third, the software allows a growth in the independence, self-regulation, and self-responsibility of the students, which is also possible because the students themselves can assist each other in communicating with the computer. This advantage will increase when the students get older.

Fourth, specific operationalization of e.g. giving equal opportunities to students from ethnic minorities, introducing quality standards in education, or increasing safety at school becomes possible. Here, systematic innovation support will be needed in the developing kindergartens and schools. In the long run, the software can act like a supportive planning and instructional management system for teachers, students, the school, the school board, and the parents alike.

Fifth, though quantitative data are not yet available, the hypothesis seems legitimate that the use of digital instructional management in early education will stimulate the optimization of educational processes and outcomes. Compared with traditional early education, more prosocial and constructive learning processes can be realized in practice, in collaboration between teachers and school staff, students, parents, and specialists from outside school but working within the framework of the same instructional lines and progress evaluation. Quantitative research to verify this hypothesis for students at risk in particular should be designed, but until now research facilities are only present for developmental follow-up projects. A first project in early and primary education concentrates on developing the pedagogical-didactic kernel structure, as defined above. Moreover, implementation in practice co-occurs with development and implementation of a second prototype of the digital instructional management system. The design of this Internet-based software is specified on the outlines given in Table 1.

A second follow-up project is carried out in secondary education. First, local instructional lines are developed and introduced in school practice. Teachers develop these lines within a self-chosen project on 'Water and environment', for small groups (2–4) of students. To aid the self-management of students, teachers create activity worksheets for each activity within the instructional lines. The worksheets contain aspects of preparatory instructional specifics, the actual performance, and the evaluation of project activities. Curriculum and learning materials are present in or around the classroom, school library, or the Internet. The worksheets provide instructional information about learning processes, materials and sources, appliances that can be used, and diagnostic evaluation. Evaluation and judgment become more individualized, but reliable or valid achievement indicators or norms hardly exist at present. Development of such indicators will become possible by authoring Internet-based software, comparable to the second prototype for early education. This prototype for secondary education is now under development.

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Peer Online Discourse Analysis

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Short Description

This session will analyze peer online discourse on a collaborative team problem solving assignment in a large college class, in an attempt to understand the group dynamics in online collaborative environments. Issues and problems associated with peer online collaboration and implications for the possible roles of instructors and instructional designers will be discussed.

Abstract

Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can promote group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Computer technologies, as scholars believe, can support collaborative learning and be beneficial to learners in many different ways (Harisim, 1990; Bonk and King, 1998; Lin et al, 1999; Schwartz et al, 1999). Various forms of Computer Supported Collaborative Learning (CSCL) have now been widely used as supplements to traditional classroom learning as well as in distance education (Bonk and King, 1998).

Research shows that learning in groups improves students' achievement of learning objectives. Some indicate that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Kearsley, 1996; Brandon & Hollingshead, 1999; Bernard et al, 2000). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research which indicates that when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? This question is a difficult one to answer, but this study begins to answer the question by investigating the ***quality*** *of peer online discourse. This study discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.*

In this study, complete electronic discourse transcripts of college students in a collaborative problem solving assignment will be analyzed to measure the quality of peer online collaboration with the two different methods, to help understand the group dynamics and types and patterns of social interaction which occur online.

Introduction

Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can facilitate group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999)

Computer technologies, as demonstrated in research and practice, can support collaborative learning and be beneficial to learners in different ways (Harisim, 1990; Bonk and King, 1999). Computer technologies, for example, make collaborative learning achievable even when face-to-face communications are less accessible, and more importantly, they can be designed to support delayed reflection (Lin et al, 1999; Schwartz et al, 1999).

Statement of the Problem

As computers and networking technologies are introduced into education, the form of education is changing dramatically. A variety of computer-supported education has been widely used to promote learning beyond the limits of geographic location and time. With technologies available today, learners can establish connections and contacts with instructors and peer learners beyond the traditional classroom. Computer Supported Collaborative Learning (CSCL) Tools, including online forums, facilitate learning by offering opportunities for interaction and collaboration. Online forums, as one of the most widely used CSCL tools, have been introduced to today's colleges to facilitate peer collaboration (Bonk and King, 1999).

In large classes, students often feel little attention to their individual needs, and may sometimes consequently feel isolated in the learning process. Active learning in large classes often occurs in group activities. This group collaboration has been shown to enhance learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Some research indicates that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research that shows when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach of peer online collaboration is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? Redundant with above, use one place or another, or re-word. This question is a difficult one to answer, but this study begins to answer the question by investigating the **quality** of peer online discourse and discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.

Research Question

This study begins to consider the question of online peer collaboration structures by investigating the quality of peer online discourse. More specifically, the study intends to explore if there are differences in the quality of students' online collaboration in the two types of online collaborative forums, and tries to understand why such differences, if any, occur.

Definition of Terms

In an attempt to alleviate any confusion due to the use of different terminology, relevant terms are defined based on how they are used in this study.

- Collaboration:

Mutual engagement of participants in a coordinated effort to reach a shared goal. Bruner (1991) defines collaboration as a process to complete tasks that cannot be fulfilled individually, or cannot be done efficiently otherwise. Mutual engagement includes joint efforts to develop a set of goals and directions; to share responsibilities; and to work together to achieve those goals, utilizing the expertise of each collaborator.

- Computer Supported Collaborative Learning (CSCL):

An learning method that implements information and communications technology to facilitate collaborative learning (Wasson, 1997, 1998).

- Online forum:

An asynchronous electronic means for communication and collaboration, where participants can post and respond to messages and discuss and collaborate on the Internet.

- Peer-controlled online forum:

A web-based bulletin board for peer learners to communicate with one another as they wish without moderation or any other active participation of the instructor.

- Structured and moderated online forum:

A web-based bulletin board for peer learners to communicate and collaborate, where the instructor takes active responsibility to structure, scaffold and moderate the collaboration.

- Problem solving:

" In general, problem solving involves dealing with new and unfamiliar tasks or situations that present some obstacle, and relevant solution methods are not known. In Gagne's conditions of learning, problem solving is the skill of recalling and applying a set of rules in the proper sequence to solve a problem. It is also referred to as higher-order rule learning" (Gredler, 1997, 364).

LITERATURE REVIEW

Sociocultural Theory

Vygotsky states that learning is a developmental process, and it occurs in social activities (Driscoll, 1994). One of Vygotsky's most influential contributions is to analyze human psychological development from a social-cultural history method (Gredler, 1997). As Vygotsky notes that higher ordered, complex thinking is gradually developed through social interactions with others in the culture (Gredler, 1997).

Consistent with sociocultural theory, research shows that learning in groups improves students' achievement in various learning objectives and some indicate that a role of facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Research shows that successful group learning promotes higher order thinking (Blumenfeld et al, 1996).

As Vygotsky (1978) points out, the learning environment is critical, as people learn from people around them and are influenced by the culture of the learning context. According to Sociocultural theorists, people learn from mediations and scaffoldings, which are offered within one's zone of proximal development (ZPD) from more capable peers or expert (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). Vygotsky defines ZPD, one of the key concepts in the sociocultural theory, as the distance between one's independent competency and that obtained with assistance from the expert or in collaboration with more capable peers (Wertsch, 1985). Such a distance can be bridged by scaffolding, as external assistance is gradually reduced and the learner finally achieves independent competency in the task (Gredler, 1997). Research and scholarship also claim that computer supported collaborative learning environment can provide the Zone of Proximal Development (ZPD) (Salomon, Globerson and Guterman, 1989; Newman et al, 1993). In collaborative learning environment, learners' ZPD can be reached and extended through communications and collaborations with peers and the instructor. Also the applications of computer technologies can help scaffold within learners' Zone of Proximal Development in collaborative learning and therefore to promote learning outcomes.

Collaborative Learning

Collaborative learning, consistent with sociocultural theory, is gaining more and more attention in education. Social interactions play an important role in learning (Vygotsky, 1978); in fact peer group work can have significant impact on varied learning outcomes (Jonassen et al, 1995; Berge and Collins 1995).

Very often, independent and individual learning can leave a learner passive and inactive. Vygotsky (1978) suggests that collaboration should help individuals make progress through their zone of proximal development by the activities in which they are engaged. Collaborations in peer group work increase engagement in the learning process, and facilitate cognitive development. Collaborative learning changes the traditional teaching and learning practice; the instructor is no longer simply the "knowledge giver" or the center of power in the learning process. Instead, peer collaboration transformed traditional education to learner-centered, active "learning" activities. In peer collaboration, learners share knowledge, ideas and significant thinking, and therefore learn from one another and achieve goals that may not be obtained in isolated individual learning. Interpersonal communications enable and encourage learners to confer, reflect and help to develop meaningful learning (Johnson and Johnson, 1975; Clements and Nastasi, 1988).

As students are led to reflect upon and confront different ideas in peer collaborations, to provide meaningful feedback and support to one another, Cazden (1988) suggests that learners therefore can learn in a constructive way and benefit in cognitive development. Research shows that to learn and work with a small group can facilitate learning as opposed to individual learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999).

Collaborative learning environments provide a means to create more engaging and dynamic instructional settings. Research frequently shows that there are clear educational advantages to be derived from collaborative activities among students (Del Marie Rysavy and Sales, 1991; Slavin, 1992).

Computer Supported Collaborative Learning

Computer technologies have further extended the formats of collaborative learning. Varied forms of Computer Supported Collaborative Learning (CSCL) have been adopted in education of both cognitive and affective domains (Clements and Nastasi, 1988; Hoopers, 1992; Repman, 1993; Jehng, 1997; Rada and Wang, 1998). Researcher (Dede, 1996) suggests that collaborative online learning should be integrated into higher education in the twenty first century.

Asynchronous online forums further facilitate self-paced and self-controlled learning and collaboration. Asynchronous online forums extend peer collaboration beyond the classroom, expand learners' control over the time for collaboration, and increase the time available to read, to reflect and to reply to a message and formulate ideas in writing. Scholars (Vygotsky, 1978; Harasim, 1990) believe that the change from oral to verbal communication also contributes to learning effectiveness when learners have to concrete and articulate their thinking in writing. Asynchronous online forums also extend the time span for peer collaboration, making it more flexible. Learners can conduct the collaboration online as long as needed, and therefore can possibly improve in-depth investigation of the collaborative task (Harasim, 1990).

Virtual discourse in online forums can be stored and easily retrieved, and hence can facilitate delayed reflection, and is always open to review (Scardamalia and Bereiter, 1994; Blumenfeld, et al, 1996). Technologies also make participants' thinking and reasoning visible (Lin et al, 1999). By requiring students to articulate their thinking, by facilitating comments and communications among learners, and by making it easy to view by thread, date or author, instructors can use asynchronous online forums to support delayed reflection. In addition, experiences indicate that some students that are not comfortable in classroom collaboration can be very active and engaged online, as there is no time restriction or competitions or interruption in the course of peer collaboration (Harasim, 1990). In asynchronous online collaborative environment, even less active learners can have the same time and opportunity to express themselves, without fear of being interrupted by more aggressive peers. In this sense, it can ensure equal opportunity in peer collaboration.

However, online collaboration forums do not simply make peer collaboration easier. First of all, asynchronous online collaboration is very different from face-to-face meetings. Participants communicate not in the real time but in the times at their individual choice. Yet the lack of non-verbal communication in an online forum makes misunderstanding and miscommunications less detectable, and thus requires higher communication competency in writing. Concerns for miscommunications can make participants more conscious and nervous about writing and diction in their online collaboration efforts. Second, learners may feel frustration with the technology itself. They may also feel like they are "talking to a vacuum" when no immediate response is available. In addition, consensus can be more time-consuming and is generally more difficult to achieve in online collaborations. Moreover, the quality of decision may be sacrificed to compromise delays caused in online collaboration (Harasim, 1990).

Scaffolding

Closely related to the Zone of Proximal Development is scaffolding. Scaffolding refers to varied forms of external support and assistance to learners to complete a task that is beyond their individual, independent efforts

(Gredler, 1997; Bonk and Cunningham, 1999). Scaffolding is also a process to gradually reduce expert assistance as the learner gets more and more competent at the task in the learning process (Gredler, 1997). Scaffolding efforts are to provide necessary assistance and therefore to help learners achieve the zone of unknown gradually.

Scaffolds can be provided by different external agents, teachers, peer learners or supporting materials (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). With computer technologies, several design features can be embedded to provide scaffolds such as process display, process prompts, process models and reflective social discourse (Lin et al, 1999).

As suggested by research and scholarships, the role of facilitator can smooth the process of collaborative learning (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). In collaborative learning environment, the role of instructor changes from the center of authority to a facilitator or co-conspirator (Hamm and Adams, 1992; Flannery, 1994). In the peer collaborative learning environment, the instructor does not serve as an information giver, but rather, learners have more active control over the learning process. In addition, students need to be engaged in a very rich context to collaborate and develop higher order thinking (Bosworth and Hamilton, 1994). Similar to traditional classroom collaboration, in online collaborative learning environment, the instructor can take the role of a moderator and facilitator as needed in the course of peer online collaboration. Supports that the instructor can provide in the learning process include motivating students, monitoring and regulating learners performance, provoking reflection, modeling, moderations and scaffolding (Brown & Palinscar, 1989; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Brandon & Hollingshead, 1999; Jonassen, 1999).

Forms of scaffolding can include hinting, elaborating, guiding, questioning, prompting, probing, simplifying, or other similar learning supports (Bonk and Cunningham, 1999). The scaffolding efforts can also be classified as conceptual, metacognitive, procedural and strategic scaffolds, as Hannafin et al (1999) suggest. Conceptual scaffolds are to guides students in what to consider; metacognitive scaffolds are to guide how to think during learning process; procedural scaffolds are to guide students how to utilize the available features in the learning environment; strategic scaffolds are to provide macro-strategy initially or ongoing as needs or requests arise so to guide students in analyzing and approaching learning tasks or problem (Hannafin et al, 1999). The various scaffolds can be embedded in a well-designed computer supported collaborative learning environment and therefore to enhance learning and improve cognitive performance.

Structuring and Moderating Online Forums

Some research documents that when participants have more active control over the learning process, learning increases (Jensen, 1996). Therefore less participation of the instructor may foster more active learning. But as some research indicates, participation in electronic discussion is often passive without instructor's participation. As Aviv and Golan (1998) report, most students in distance learning environments participate in electronic discussions by passively reading some peers' postings, and only responding to a few of others' messages, also very few students raise questions. Aviv and Golan (1998) also found that when preplanned, and focused, and students are led through the learning process, electronic discussions can lead to a highly successful learning experience. Scholars (e.g. Slavin, 1995) recommend the use of structured protocol to direct interactive discourse among peer learners so to reduce off-track and passive behaviors while ensuring opportunities for equal participation.

When shifting from the "center of authority" to "co-conspirator," the instructor needs to take substantial responsibilities in the course of collaborative learning in order to foster a learner-centered peer collaborative learning environment. As for students' participation in online collaborations, strong social skills and good group dynamics are essential to effective and productive learning outcomes. Group dynamics contribute to students' performance in collaborative learning and their satisfaction for the learning experience (Bosworth and Hamilton, 1994). Some participants' actions of "free riding" and "social loafing" and failure to contribution, however, can damage others' enthusiasm and motivation in the course of collaborative learning. In addition, the feeling of "talking in a vacuum" with online collaboration and other frustrations with technology and many other factors make online collaboration a challenge to many participants. Research indicates that even in learner-centered learning environment, as in online collaborative learning, moderations and structuring of the learning process are needed for successful learning experiences (Flannery, 1994). Online collaborations need to be well organized, facilitated, and moderated to be effective and successful (Hamm and Adams, 1992; Flannery, 1994).

Structuring

Little research has been focused on how to structure peer online collaboration. In practice, peer collaborations are often structured by the learners themselves by chunking the group assignment into "detailed division of labor" (Althauser and Matuga, 1999). In order to reduce "free riding" in teamwork, instructors also often structure the online peer collaborations by assigning a set of questions to each member of a group. Therefore every group member must participate by taking charge of the part of the task to which they are assigned. Such structuring, however, has drawbacks, as it tends to lead students to work on the group assignment in a cooperative way and thus miss the opportunity for collaborative learning. Individuals can execute their own part of the assignment without collaborative efforts from peers, and they may not contribute to other part of the assignment either.

Bosworth and Hamilton (1994) suggest that instructors create and develop requisite structure and process of the group to achieve better collaborative learning. Similarly, Slavin (1995) suggests using structured protocols to direct student interactions. Efforts of structuring peer online collaborations in this study are two fold, one is to structure group work, and the other is to structure the collaboration in online forums.

Moderation

The importance of moderating peer collaborative learning has been recognized in practice and research (Harasim, 1990; Hamm and Adams, 1992; Bosworth, and Hamilton, 1994). Bernnard et al (2000) also suggest that instructors assume a facilitator's role in an online collaborative learning environment. Strategies for online forum moderation include, but are not limited to the following: to maintain the discourse focused on the topic, to check team progress, to promote equal participation, to provide individual support as needed.

Research Design and Implementation

The study was conducted in a large undergraduate introductory statistics course at a major university in the northeastern United States. As a required course by many majors at the university, this course included students from all majors and class standings. Forty-one groups, consisting of one hundred and forty eight students volunteered to participate in this study. All the participants were already experienced with teamwork in this course before the study began. Participants were given the opportunity to re-form teams of four or five each, based on their past team work experience with others in this course. The forty-one groups were then randomly assigned to either of the two types of forums (peer controlled or structured and moderated) and asked to collaborate on twelve problem solving scenarios in the online forums as a team assignment. As a result of the random assignment, twenty-one groups were using the peer-controlled online collaborative forum, and twenty groups were using the structured and moderated online forum. Each team was provided a private online forum, which only team members had access to. For each scenario, participants were asked to recommend an appropriate statistical technique to address the problem and provide justifications for the recommendation. The study took place in the last few weeks of the semester when students were extremely busy with finals, projects and exams for other course work, and participants had two weeks to work on the assignment before final submission. Before the study began, the participants had already experienced many technology-enhanced learning opportunities in this course, such as a course website, the password-protected web-based electronic textbook, online quizzes for individual assessment, and online forum for group and/or class bulletin board.

Teams assigned to the peer-controlled collaboration forums worked with their team members on the problem solving assignment without any intervention from the instructor or anyone else. Teams assigned to the structured and moderated collaboration forums, on the other hand, were closely monitored by the instructor and received scaffolding, moderation and structuring prompts from the instructor as needed.

Data Collection And Analysis

All the electronic transcripts of each group's discourse on the online forums were collected in a previous experimental study conducted by the lead researcher and analyzed with multiple-party discourse analysis principle applied. Since this research was interested in teams rather than individual behaviors, each team's electronic postings on the private forum were saved and analyzed as one single unit.

Data were stored and organized in NVivo, a Qualitative Data Analysis (QDA) software. The researcher also wrote memos for each group to record general impression and important thoughts each time reading and/or coding the transcripts, and those memos were then analyzed together with the electronic transcripts.

The data analysis was carried out as an ongoing process as the research proceeded. when the teams were using the online forums for the problem solving assignment, the first author read the electronic transcripts as they became available everyday and wrote brief memos to record ideas and impressions constantly. Reading the transcripts and recording initial ideas as an ongoing process helped the researcher to understand the dynamic nature of teamwork and online collaborations. It felt like the researcher were experiencing the team process, learning and observing collaboration real time as the participants did. It enabled the researcher to capture the dynamic nature of teamwork without meeting any of the participants in person or interrupting/disturbing the team dynamics.

Some teams used the online forums, which were originally designed to be synchronous communication tools, for real time team collaborations. They set up a time that all members logged on and conducted the collaboration as if in a real time face-to-face meeting. In those incidences, the lead researcher, when she happened to be online exploring those forums, or when she knew the meeting time from their previous communications, then observed the team's online collaboration as if in a real-time observation.[13] While reading the team dynamics, the lead researcher took notes as if in a synchronous observation, and those notes were also analyzed together with the original transcripts.

When the team online collaborative assignment was due, all teams' online discourse was saved as electronic transcripts. Those electronic transcripts, which were collected in a previous experimental study (Zhang, 2000; Zhang & Peck, 2001) and now analyzed for an alternative perspective on and deeper understanding of the original questions, could be considered as secondary data (Hinds, et al 1997, Szabo and Strang 1997). Researchers (e. g. Hinds et al, 1997, Sandelowski 1997, Szabo and Strang 1997, Thorne 1994) argue that secondary data analysis can be deployed to revisit existing theories and/or generate new knowledge. The memos the lead researcher took, either when observing team collaborations real time or when coding and re-coding, were primary data. Both primary data and secondary data were analyzed together in this study.

As the research question was particularly interested in comparison, which is a basis of discourse analysis (Lemke, 199?), discourse analysis principles were very appropriate as an attempt to understand the team interaction pattern. As researchers (e.g. Lemke,199?) believe that language written or spoken, as research data should be translated from the activity in which it originally functions to the activity in which we are analyzing it. Also human discourse is, by nature, highly contextual, online or in person, thus it was critical for the researchers to visit and re-visit the electronic transcripts frequently through the study. And the real time observations played an important role in helping the researchers understand the context of the collaborations when they happened and hence enabled the researchers to interpret the language and interactive rhetoric as close as we could.

Researchers identity

The lead researcher was also the primary researcher of the study from which the electronic data was gathered so she understood the data collection process and the context in which it was generated. During the experimental study, where participants were first introduced to the online forum as a collaborative learning tool, the lead researcher was also working closely with the students and instructor of the course as the technical supporter and was actively involved in setting up the forums, facilitating re-grouping and provide resolving technical issues. Yet most of the contacts between the lead research and the participants were through email, the online forum or indirectly through the instructor. Since the experimental study only lasted for two weeks, lead researcher did not become to know any of the participants in person, nor did she become familiar with any of them. The physical and psychological distances, which were generated from the little personal knowledge and only electronic communications, served both good and bad for the research. On one hand, the distances enabled the researchers to be closely engaged with the data, the online discourse transcripts, while staying detained from the participants. Thus the researchers were able to study the groups with little personal bias on particular participants. Yet on the other hand, in the data analysis process, the researchers often felt the strong curiosity to get to know the participant in person as they came out vividly as live characters fromtheir online discourse. Also the nature of the medium had limited the communication cues (Daft & Lengel, 1984; Fulk et al, 1990), and the researchers felt some personal contacts with the participants might have helped interpretation of the discourse, or might have led us to a more in-depth understanding of the group dynamics as well as the problem solving process.

We did line-by-line coding to generate initial ideas and categories and tired to discover the relationship among concepts, or nodes as referred to in NVivo. The researcher first coded five files line by line, using only free nodes to get a sense of the data. As inducted from the data, we noticed that the transcripts could be categorized into four major groups of codes, team process related, task related, media related and relationship related, which were referred to as tree nodes in NVivo. The four categories were also consistent with literature on teams in organizations

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[13] We think it *is* observation, which happened to be occurring online. Having obtained participants' consent, the lead researcher still felt facing the ethical issue of 'lurking" while observing the online collaborations.

(e.g. Guzzo & Dickson, 1996) and information and communication technology (e.g. Daft & Lengel, 1984; Fulk et al, 1990; Fulk, 1993; Gunawardena, 1995). So we re-organized most of the free nodes into the four major themes as tree nodes in NVivo, task-related, team process, relation related and media-related, each with extended nodes under it. In the coding process, we used the tree nodes to help categorize ideas and identify the team collaborative process and quality. In the coding and recoding process, we constantly needed to add, change or modify the nodes and their relationships as indicated in the tree nodes structure, since our interpretation and understanding of data was developing and merging throughout the process.

As the data indicated that the major theme was task-related, in the late stage of data analysis we started from a key node, interactive collaboration, which was identified as the most important node from task related tree node, and tried to figure out the possible relationships among the nodes. The researchers also used the concept mapping software, Inspiration 5 and the modeling feature embedded in Nvivo to untangle and present the relationship among the key nodes. A model of team discourse was developed later for each approach of the online collaborative forums.

Scholars (Lincoln & Guba, 1985; Moustakas, 1994; Stake, 1995; Creswell, 1998) suggest the application of various techniques to ensure the quality of qualitative research. We invited colleagues and peer researchers for review and debriefing throughout the research. In addition, the first author met with a colleague twice a week in the data analysis process to discuss and reflect upon the research process and to ask for an outsider's opinion on the interpretation and coding of the data. Also the researchers were constantly engaged in academic discourse with peers for alternative interpretation and representation of the data in lively discussions. The scholarly communications between the researchers and with peer researchers helped to validate and establish trustworthiness of the research. Also with the concept mapping and the QDA software, the researchers were able to constantly refine the coding and analysis through the research.

Findings

A model was developed for each type of collaboration forum to represent the major findings of this study. (figure 1, figure 2 inserted here.) As indicated in the model, there are two major differences between the online discourses in the two types of forum, peer-controlled and structured and moderated. One was the presence of strategy that guide through the four major themes (i.e. task-related, interaction pattern, relationship-related and media-related). The other was the strength of interactive collaboration.

Discourse occurred in the structured and moderated forums started with a strategy, in the form of a proposal for or discussion of a strategy, which then generated shared agreement on how to process the problem solving assignment as a team. Such strategies often included two aspects, one about team processing, (which was reported in the models as interaction pattern, because the researchers decided that the two-week discourse was too short and not rich enough to determine the team processing pattern) and another for the team task. Many teams started with a clarification of membership, since they were re-forming a self-selected group, and started with questions, suggestions or statements on how to collaborate on this assignment.

Interactive collaboration as merged from the data was conducted through simple agreement, agreement with elaboration, question and answer, and disagreement. In forms of information seeking, asking/providing clarification, challenging other's ideas and further questions that led to active learning beyond the scope of the original task. Through interactive collaboration, participants experienced self-reflection and critique, made connections and comparisons with previous learning, and searched and utilized other resources. Such interactive collaborations did happen in both types of forum, yet it was evident that in the structured and moderated forums, groups had more intense and orderly interactive collaborations and did achieve active learning through the collaborative inquiries, while in peer-controlled forums groups often stayed with individual and/or fragmental reasoning and many left the forums without any interaction or collaborations. The one-way, individual reasoning, together with simple agreement without reflection or elaboration on it, fail to lead the teams experience real collaborative learning and thus lost opportunities for shared active learning. Simple agreement, which happened very often in the peer-controlled forums, indicated only shallow, superficial, interactive collaboration, if we considered it as collaborations at all.

Starting with a strategy, or the efforts to build some strategy in the early stage of the task also helped the teams to establish a mutually agreed interaction pattern with people taking the leadership role and organize the collaboration in a well-accepted fashion. Such efforts were evident in the structured and moderated forums and the interactions thus were more clearly organized and processed. Yet in the peer-controlled forums, teams either did not interact at all or did it in a more or less chaos or similar manner.

Closely related to the interaction pattern and task-related themes were the relationship-related issues as indicated in the data. Teams that showed mutual respect and provide support and encouragement to one another were also showing interaction patterns in an orderly manner, and had more frequent and in-depth interactions with one another. In peer-controlled forums, teams either went off-topic and spent a lot of time in the online forums on relationship-related issues or did not show any evidence at all on team member relationships.

Online forums at the time the data was collected were, and probably still are, a new medium for learning as well as communication. Part of the task-related and interaction patterns, as shown in the data, was about the team collaboration media. Teams chose different media to meet their needs for collaborations at different stage of team problem solving. Those choices varied from team to team. Yet it was clear to the researchers that the choice of medium that matched their needs was critical for the successful of team collaboration process and relationship-related issues.

Courseware & Copyright: Who's Rights Are Right?

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Short Description

This session addresses the difficult issues of balancing faculty and university rights and responsibilities regarding courseware and courseware modules developed as both commissioned and non-commissioned works. The ways in which this debate affect those who are engaged in a) building their own online courses for their universities; b) courseware development as consulting practice, and c) work for universities as faculty development web development experts will be addressed.

Introduction

The application of the web to higher education has brought with it many new and, at moments, disturbing systemic impacts that significantly effect the work of instructional design faculty and instructional designers in higher education. On-line learning is a considerably different approach to higher education (Daniel, 1996; Gubernick & Ebeling, 1997; Hall, 1995; Chea, 2000) and creates important new challenges including what counts as digital courseware, how is courseware different from textbooks, who owns courses that are designed for online learning, under what circumstances, and who controls those courses into the future? Most of these questions have been dealt with substantially through a number of publications of policies for various institutions (University of Wisconsin, 1997; University of Pennsylvania, 1997; University of Texas System, 1998; University of Illinois, 1999; University of California, 1999; University System of Maryland, 2000; Penn State, 2000) and through a number of think tank reports (CETUS, 1997; AAU, 2001; Twigg, 2000; AAUP). While a good deal of work has already been accomplished examining courseware and copyright issues, none has linked these questions and policy discussions specifically to the work of instructional designers.

Thus this work is an extension of the work begun by many policy makers, administrators, lawyers, faculty members, and intellectual property scholars. Specifically, this paper will look at the potential impacts of a variety of copyright issues on the work that instructional designers do—particularly in the online educational development enterprise.

There are two primary roles that instructional designers hold in the university, as service professionals and as faculty. As instructional design professionals, the impact of policies, which may serve to encourage or discourage faculty participation in the creation of online courseware may have broad and sweeping impacts. For the first time since the inception of the field, courseware has brought the field of instructional design into the university administrations' radar screens. There is a sudden realization that in order to effectively move the traditional face-to-face course, which always required a human professor to make the pedagogical connection to extant materials (Hiltz & Wellman, 1997; Twigg, 2000) into the digital format requires these people called instructional designers. This has been a serious boon for our field, although at times there is a perception of our academic programs as being primarily service oriented rather than content oriented or research based-- a common problem for our field addressed by Heinich (1984). If policies are formulated which intimidate or worry faculty, there is likely to be a chilling effect, and a lack of interest in pursuing the creation of courseware on the part of faculty. Without the faculty, who are essentially the SME's or content providers, the instructional designers would certainly have a difficult time putting courses online. And some would question the ethicality of pursuing online learning in the absence of generalized faculty support.

In addition, instructional design faculty members are very interested in many questions associated with the new online higher education enterprise. It is an opportunity for consulting as well as research and scholarship. Here again if policies constructed by the institutions are narrow in their understanding of the work that instructional design faculty do in this regard, they could find themselves asking permission for each project from upper administration and constantly defending their work in an effort to show it is not a conflict of interest or infringement of narrowly construed intellectual property, courseware or copyright policies. This paper considers the specifications of three policies being considered at three institutions: Wisconsin, Madison, University of Texas, and Penn State as examples and as a contextualized basis for further discussion of the potential impacts of such policies on our work as instructional designers and instructional design faculty.

Instructional designers have been actively involved in design, development and delivery of online education, when building their own online courses for their universities; developing courseware as consulting practice, and/or serving as subject matter experts. Thus university courseware policies, both directly and indirectly, have significant impacts on instructional designers working in higher education. Considering the varied roles that instructional designers play in a university, we will be using university personnel in this paper to include faculty members, staff, and professionals engaged in courseware development. First we will examine some of the concerns that are raised initially as one considers courseware copyright policies, then we will turn our attention to more deeply understanding three contexts in which courseware copyright policies are either being considered or have recently been passed into campus legislation. Finally, we will reconsider the concerns that evolve from that deeper understanding of these new policies.

CONCERNS

Academic Freedom

Perhaps one of the most prevalent concerns voiced by faculty members in many subject areas is the extent to which the rules are somehow changing in this new technological world. Faculty are concerned that if courseware policies are passed, it may lead to infringements on academic freedom. These concerns actually take the form of several specific worries. First, faculty members are very concerned about their mobility as scholars, designers, and creators if university claims strong ownership and rights on courseware. If a faculty member leaves their home institution for another position, but their courses were online, to what extent will they be able to take their courses with them to their new place of employment? While it is clear that a faculty member takes their knowledge with them, and also that they would not be allowed to take the specific software solution designed for a given university with them, the questions of the gray areas are much more confusing. For example, let's suppose that a faculty member designs a course, an online course, with substantial support from their institution. They work with instructional designers, graphic artists, and software experts and create a really wonderful course that utilizes a very innovative *method* for delivering the instruction. The given method is the original idea of the faculty member, not the collaborative outcome of the work with instructional designers. The home institution could, under certain circumstances claim ownership over not only the specific course solution that was built utilizing their substantial resources, but also the innovation of the method itself, something that the faculty member originated and certainly planned to replicate perhaps in another medium at their new position.

Control

Within the academic freedom area of concerns is another important general category—control. To what extent will the faculty member control the frequency, updating, and actual implementation of the course they have built. Here again, given certain policies, there is significant danger that courses will be under the control of administrators who may have more interest in profit than in fidelity to a given subject area. Faculty worry that their work may be changed without their approval, utilized without proper attribution, or offered far into the future under the direction of instructors without a significant commitment to the field being taught. Naturally, t is frightening to consider the possible replacement of professors with courseware without recognizing the creators, to use, modify, transfer or commercialize courseware without consultation with or permission from the original faculty authors (Farrell, 2001; Twigg, 2000; AAUP, 2001).

Defining Roles

Clearly one of the fuzziest areas to many faculty are the understandings of the roles of faculty and support staff in the creation of online learning resources. In general, the administration at most institutions focus on the commitment of the faculty member to the institution, suggesting that it is a normal part of their job to create online learning materials and that they should not expect either ownership or additional pay, though they should be given the tools to enable the creation process. On the other hand, based on a history of textbooks and prior use of course materials in workshops, consulting, mini-courses, classes on tape etc, the faculty member understands the course as a basic unit owned by them. It is their content knowledge, their creation and has typically been their property in the past. While many institutions have long standing policies indicating that the syllabus for a given course is owned by the university, this is so rarely enforced in terms of mobile faculty or consulting usage that most faculty are unaware of such policies where they exist. In essence, many faculty see that the institution is there to serve them in their quest to advance the knowledge in their given field, while the administrators see the faculty as there to serve the advancement of their home institution. The way that one interprets this conflict typically speaks clearly to the sorts of policies that are likely to result. Faculty members typically want very faculty-friendly policies, while administrators are looking for protection for the institution from competition in this new cyber-education world.

How to define substantial?

Related to the understanding of roles is the subsequent understanding of the term "substantial". This term is used extensively throughout the copyright literature and the resulting copyright policies. The use of substantial university facilities and/or personnel is often one of the most important or even determining factors in sorting out university ownership of courseware. Yet the concept of substantial is far from clearly defined. Partially because of the distinctions in roles discussed above, the concept of substantial resources is extraordinarily open to interpretation. The State University of Pennsylvania system, for example defines it as at least $40,000 per project. This seems like perhaps the clearest definition of substantial that we have found in the literature. In general the term is defined in much more nebulous ways such as the "use" of instructional designers, graphic artists, working with a particular support arm of the university or the like. How much or how little is rarely as clearly defined as it has been at U Penn. However, even with this clear financial figure, still it is unclear precisely how that number is calculated. What "counts" and what doesn't is not as clear as everyone would like. The U Wisconsin has a relatively detailed definition of "substantial" (See Table 1), yet the "extraordinary" use of computing resources remains a nebulous term and therefore unclear in terms of how it will be measured.

Given the varying roles the institutions and individual professors may play in the creation and development of courseware, it is not likely that a single principle of law can clearly allocate copyright interests in all cases (AAUP 1999). Generally the following instruments are deployed to address the courseware copyright issues: individual negotiations and signed agreements between individual university personnel and institutions; collective bargaining agreements between the university and personnel; and university copyright policies (Morgan, 2000). Many universities (e.g., University of Texas, University of Wisconsin, and Penn State University) have made efforts to develop a courseware policy to provide a framework on how to address courseware copyright. Generally three models of ownership are applicable, i.e. university ownership, university personnel ownership and joint ownership. The most common factors used to determine ownership include, but are not limited to the following: (1) the conditions under which the courseware is developed; (2) the scholarly nature of the product; (3) the commercial character of the work; and (4) the scope of employment.

Characteristics of AAU (1999) Model

The current debate on whether to treat courseware as traditional textbook or as patentable innovations, as AAU (American Association of Universities) interprets (AAU, 2001), focuses only on the product, and AAU calls for a shift of attention from the product to the process when addressing courseware related copyright issues. The AAU model primarily represents the interests of the institution, or the administrators within the institution. AAU (1999) argues that courseware is a "collaborative creation" at a university. Based on this assumption, AAU further proposes that "the university should own the intellectual property that is created at the university by faculty, research staff, and scientists and with substantial aid of its facilities or its financial supports." (AAU 1999).

Being very aware of how difficult it could be due to the complexity of new media products, AAU still proposes that generally applicable formulas should be available to allocate the sharing of returns on digital media products among individual faculty, departments, schools and the university.

For the products that do not rely on the university resources and not for use at the university (e.g. in courses), the university may not claim interests in them, yet the definition of "reliance on university resources" remains less than completely defined. Here is raised a particularly interesting set of questions. While it may be clear to many faculty that the use of $40,000 or more of university resources justifies university ownership of courseware, if the faculty member does the work on his or her own time, then it would seem intuitively obvious that the university ought not to interfere with the use of these materials. This is particularly the case if the materials are not in substantial overlap with the faculty members' duties at the university. However, university administrators are concerned about increases in competition for almost any online product that a faculty member at their institution may produce for a mass market. From the institution's perspective, if people can gain access to famous faculty members online cheaply, or potentially cheaper than through their own university tuition and fees, then what could compel them to spend more? And then what protects the university under those circumstances from a substantial loss of income because the faculty member is essentially competing against his or her own institution. We will revisit this question in more depth during the final section of this paper.

Portability of intellectual property

AAU questions if courseware should be treated differently from patented discoveries, which belong to the university and are not portable with the faculty who invent them. Here we sense the blurred distinction between teaching and research, knowledge and products. The patent for an invention remains with the university who is granted ownership in the traditional custom, yet courseware is not a simple product, it is more likely to be a representation of knowledge and scholarly thinking, which is always expected to be continuously constructed through the journey of delivery as well as constant updates. It is potentially dangerous to view courseware as a one-time invention and thus to limit the portability of it. Also the importability, if defined in university courseware policy as suggested by AAU, will cause cautiousness among faculty members about their academic freedom, and is quite likely to reduce their motivation to design, develop, maintain, or update courseware.

Characteristics of AAUP Model

If the AAU model represents the institutional perspective, then the AAUP (American Association of University Professors) model represents the faculty interests. AAUP (2001) proposes an informed allocation of rights between faculty and universities in forms of ownership, control, use and compensation. AAUP (2001) classifies the general projects into three categories: works that are properly considered "made for hire," negotiated contractual transfer, and joint works as defined by the Copyright Act. AAUP (2001) further stresses that regardless of the ownership of the courseware, faculty members should be given rights in connection with future use of courseware that they have been part of in the creation and development. Not only through compensation, faculty should be given the right of "first refusal" in making new versions or at least of the right to be consulted in good faith on re-use and revisions (AAUP, 2001). Those points certainly voice faculty members' concerns and are attempts to protect faculty members' rights as scholars, researchers, authors, and creators while promoting development of courseware. For instructional designers and faculty members this is really important, particularly as regards quality control and academic freedom. The AAUP plan, while it is not as faculty-friendly as some models, certainly represents the interests of faculty and tends to encourage faculty to engage in the creation of online learning materials.

Three Institutional Policies

We now turn our attention from models to specific policies. The policies of three institutions (University of Texas, Penn State, and the University of Wisconsin. We chose these three because they have all been recent negotiations and because we believe that they represent significantly different types of institutions. While all are relatively large public institutions, politically they are quite diverse in their histories and past policies.

University of Texas' courseware policy has been recognized as the model for electronic course materials ownership (Farrell, 2001). And the American Association of University Professors uses University of Texas' language as a template for its own policies and guidelines on the matter (AAUP, 2001). Thus the UT policy is perhaps the benchmark that other universities are typically considering as they create their own policies. Penn State after some lengthy debate in the faculty senate has just passed a courseware policy recently. And we think it is very telling to share their view and struggle with this issue. University of Wisconsin is historically a very politically progressive institution, so it would be interesting to see how they dealt with this in comparison to say PSU which is much more corporate in nature and does not have a history of progressive liberal policies.

In the following table we try to summarize the current university courseware policy at Penn State University, University of Texas System, and University of Wisconsin System.

TABLE 1

Ownership Institution	Penn State University	University of Texas System	University of Wisconsin

		(PSU)	(UTS)	System (UWS)
University ownership	Development conditions	The university initiates the development as a normal duty or special project of a faculty member for which extra compensation is provided (applicable to both commissioned courseware and commissioned courseware modules)	Any of the following: Products are created within the scope of employment Using UTS time, facility or state financial support Commissioned by the university of a component institution, either as a contract or work for hire Research supported by federal funds or third party sponsorship	Condition 1: with "substantial" institutional support or involvement In such cases the university system may assert ownership or other property interests, which should be addressed through specific agreements with the authors and producers of the materials (University of Wisconsin System, 1997, p1) Condition 2: *As assigned duty of employment* Condition 3: pursuant to a work-for-hire agreement

	Allocation of other rights	Generally, sale or use of courseware/ courseware modules in areas that substantially compete (how is it defined remains unclear) with PSU is not allowed without prior approval. For commissioned courseware: Written agreement between university personnel and the university prior to the project starts will establish the extent to which the materials may be used in derivative works published outside PSU and will also formalize the relationship with authors outside PSU, if any, and the procedure for the use of existing materials. If distributed outside of PSU, authors will receive 50% of royalty or other consideration received by the university For commissioned courseware modules: University give proper credit to author(s).		For Condition 1: Subject to a written agreement between U personnel and chief administrative officer of the institution involved to determine copyright and ownership For condition 2(assigned duty): U owns all rights, including copyrights and royalty and fees, unless a contrary agreement reached prior to the beginning of the project specifies otherwise. For condition 3 (work for hire): U receive all rights, including royalties and fees, and a written work-for-hire agreement shall be executed Fair payment shall be made to the author of the copyrightable instructional materials under the work-for-hire agreement
Definition of substantial				Released time from regularly assigned duties; direct investment of funds or staff; purchase of special equipments; use of multimedia production personnel and facilities; extraordinary use of computing resources (University of Wisconsin System, 1997, footnote 3)

U Personnel ownership	Development conditions	University personnel initiated, noncommissioned courseware and courseware modules which do not compete with any PSU programs Yet: the use of university resources to make university-personnel-owned courseware modules should use care to ensure that applicable copyright laws and policies are followed. No use of university resources, equipment, support staff, materials is allowed	General rule: author is the owner University of Texas System intellectual property policy permits faculty ownership of scholarly, artistic, literacy, musical and educational materials within the author's field of expertise. Product unrelated to university personnel's job responsibilities and no more than incidental use of UTS resources Invention that has been released to the inventor Intellectual property is embodied in a professional, faculty, researcher or student-authored scholarly, artistic, musical, literary or architectural work in the author's field of expertise	No or minimal University support or involvement "Minimal", as used in this policy, includes the use of university lab or equipment but does not include release time from regularly assigned duties. (University of Wisconsin System, 1997, footnote 2) it further defines "author", who has solely ownership for courseware produced under the above condition, as "creators of instructional materials…may include faculty, staff or students who, as a regular part of the instructional program, become participants in the creation of copyrightable materials" (University of Wisconsin System, 1997, footnote 4).

	Allocation of other rights	Control and use of personnel initiated courseware modules at no or minimum cost remain with the author(s) University claims royalty-free nonexclusive right to use the personnel-initiated noncommissioned courseware in the university program Use of university-personnel-owned courseware in the university educational programs will only be allowed under the university's supervision. Courseware provided at no or minimum cost can be supervised at the department level. courseware modules provided at minimum cost can be supervised at the department level Sale or use of university-personnel-owned courseware that compete substantially with PSU is not allowed without prior university approval	In case of educational materials that involves significant institutional resources, UTS retains rights, for example, to use the work and recover its investment. University personnel owners must share benefits with the UTS from commercializing a UTS invention released to him/her; or if the work embodying the intellectual property required significant resources contribution from the UTS or s component to create or develop the intellectual property (parties should execute an agreement regarding sharing before the project starts).	

Jointly ownership	Development conditions		Multimedia courseware and distance learning materials are very likely to be jointly developed and thus protected by joint ownership. When the university personnel's expression is added to a faculty member's contribution, it is then considered jointly-authored work, and owned by the university and faculty member. When substantial UTS resources are used in the development of a courseware, the university may claim joint ownership.	
	Allocation of other rights		Written agreements among parties involved prior to the project starts is recommended to clarify the relationships and rights.	
External /extramural support		We only find policy regarding sponsored inventions(PSU, 2001) but nothing about sponsored courseware policy		Agreement with the extramural sponsor shall be considered in determining the copyright and ownership rights of the parties.
Claims on /interest in traditional course-related materials		Not specifically mentioned in current courseware policy yet no evidence that the university would claim for ownership for traditional course materials	Not specifically mentioned in current courseware policy yet no evidence that the university would claim for ownership for traditional course materials	Does not assert interests in materials resulted in traditional teaching, research and scholarly activities

remarks	Conflict of interest/commitment is defined as: for personal financial gain	Written agreement among parties prior to the beginning of the project is recommended	Written agreement among parties prior to the beginning of a project is highly recommended to clarify rights and responsibilities of each party involved. responsible individuals are responsible for copyright-related clearance, waivers, agreement, etc. The policy encourages internal use and sharing based on agreements developed under this policy, and charges for internal use should be limited to actual, direct cost. Release to external distribution should be negotiated between the institution and the author. Revision or withdrawal: Shall not be altered or revised without consultation with the author When contrary to recommendation of the author, use, or authorization for use by others shall not be advertised or presented as the work of that author, except appropriate acknowledgement of the author's original production Author shall be offered opportunity for revision When considered for different uses than the original ones, author shall be consulted.

University of Texas System Courseware Policy

University of Texas System (UTS)' standards automatically grant ownership of scholarly, electronic learning materials to authors who create them, reinforcing the traditional presumption for scholarly writings, books and teaching materials in universities.

As Georgia Harper, section manager for intellectual property, office of general counsel UTS points out (Farrell, 2001), "Faculty certainly own their course material in a traditional environment, and so to change it — to take away something they and we believe they own — would have precipitated an immense struggle." And the merit of UTS policy is that it recognizes the presumption of faculty ownership of work they create, and faculty members feel secured (Farrell, 2001). To keep a balance between the faculty members and the university, UTS policy recognizes faculty members as owner of software and other materia ls they create, and allows the university to reserve the right to recover cost if significant university resources have been used in the development process. Now, as a general rule, teaching materials created by faculty members, regardless of the medium, leave with the faculty creators if they leave the university (Farrell, 2001).

According to UTS policy, university personnel ownership is granted when courseware is unrelated to employee's job responsibilities AND is developed with no more than incidental use of system resources. Professional-, faculty-, researcher-, or student-authored scholarly, educational, artistic, musical, literacy or architectural work in the author's field of expertise, unless is for hire, or required to, or commissioned by the UT system, will be granted university personnel ownership as well. in case of substantial use of institutional resources, the university retains rights to use the work and recover its investment, from royalty, for example, and may claim joint ownership.

The UTS policy also points out that multimedia courseware products and distance learning materials, since are more than often jointly developed, are very likely to be jointly owned by the university personnel and the university.

Penn State University Courseware Policy

After some lengthy debate, the faculty senate at PSU passed an administration-friendly policy which was promptly accepted without revision by the university president. The senate debate did raise many concerns for some faculty, but the bulk of faculty felt they would not be affected by the new policy and were willing to work with the administration to protect the institution from outside competition.

As the chair of the courseware copyright committee stated, one of the purposes of the efforts is to protect Penn State, a large traditional higher education institution from the commercial competitors such as the University of Phoenix.

The policy basically allows that the university has copyright ownership on online courses whenever the university initiates the development as a normal duty or special project of a faculty member for which extra compensation is provided.

The policy claims that for non-commissioned courseware, the university makes no claim to copyright ownership, however, it DOES claim the royalty-free, non-exclusive right to use the courseware in any university programs. Faculty have no right of first refusal. This part of the policy certainly does not incline faculty members to try to create non-commissioned online courses particularly in combination with the conflict of commitment clause discussed below.

In cases that the courseware is a full replacement of a university educational program, the use of such software is allowed only under university supervision and any courseware module that imposes a cost to students also requires university approval.

In order to protect the university from competition, faculty members are not allowed to create online courses for sale to private online institutions, corporations, workshops, or any other form which would in any way compete with Penn State. One important thing to understand about this part of the policy, called conflict of commitment clause, is that it also applies to areas far from the faculty members' duties to the university. In other words a Shakespearean scholar who chooses to create a course on gardening might run aground of this policy because Penn State, being a wholely comprehensive university, has an agricultural program that looks at gardening. Thus, if a faculty member decides, on their own, to create an online course, it may not in any way compete with PSU, if it does, it is not allowed without prior permission. So, a non-commissioned work is owned by the author, but PSU maintains royalty free non-exclusive right to utilize the materials and the faculty member is not likely to be able to sell the materials outside as it may be considered a conflict of commitment. In this case, ownership is not particularly advantageous to most faculty members which has caused some of them to chill to the idea of engaging in online course development.

In all cases written agreement signed by both the university and faculty members are recommended at the start of the project development.

University of Wisconsin System Courseware Policy

The UWS policy, as stated in the background (University of Wisconsin System, 1997, p1), was developed to address the increased institutional involvement in development of copyrightable instructional materials. It was thus written with special focus on courseware developed with substantial support form the university,

University of Wisconsin System claims university ownership on courseware developed as a) work-for-hire or assigned duty or b) with substantial use of institutional support or involvement, and the university reserves all rights including royalty and fees for work-for-hire and assigned duty and rights allocations are subject to written agreement otherwise. UWS has provided a relatively detailed definition for "substantial" which helps to reduce conflict or ambiguous interpretation of the policy.

For courseware that is developed with no or minimal university support or involvement, university personnel ownership is granted. And there are no further specifications on allocations of rights for those courseware products.

For projects developed with external sponsorship, UWS specifically states that agreement with external sponsor shall be considered in determining the ownership and copyrights of all parties involved. Nothing is specified regarding joint ownership.

Interestingly, UWS is the only one among the three institutions we investigated that has specifically addressed the issues of responsibilities of the institution and university personnel, external distributions, revision and withdrawal. The policy specifies that responsible individuals for each project, who are assigned by sponsoring departments, are responsible for copyright-related clearance, waivers, and legal agreements. The policy encourages internal use and sharing based on agreements developed under this policy, and charges for internal use should be limited to actual, direct cost. External distributions may occur as direct rental, sale, or licensing by UWS or as commercial rental, sale or distribution by a third party under agreement for payment of royalties.

Release to external distribution should be negotiated between the institution and the author.

The faculty are clearly to be consulted whenever a course they authored is to be altered or revised. When contrary to recommendation of the author, use, or authorization for use by others shall not be advertised or presented as the work of that author, except appropriate acknowledgement of the author's original production. Author shall be offered opportunity for revision unless he/she declines. When courseware is considered for uses different from the original ones, author shall be consulted. Thus these policies clearly have a high regard for the importance of faculty consultation and consequently academic freedom. The UWS policy shows respect to original authors of courseware, and ensures that authors shall be consulted for revision, alteration and different uses, regardless of ownership.

Discussion:

As we outlined above, there are many critical issues associated with current policy making provisions for copyright and courseware ownership. In our view, from our perspective on the front lines of the Penn State debates, the copyright interests are at the nexus of faculty versus administration concerns. For the faculty member there is concern over academic freedom, future use, consulting restrictions, and even job security. For administrators, there is fear of competition, lost revenues, and even *their* own job security. This particular moment of conflict between faculty and administration is an important area for further exploration not only of the impact of specific copyright and courseware ownership issues and policies, but also of the basic working relationships between faculty and administrators—particularly administrators of distance education enterprises on traditional campuses.

What are the specific issues as they relate to the instructional designer? Certainly we have already hinted at one of the biggest concerns for service instructional designers who work with faculty to create online learning materials—that of disincentives for faculty and eventual extinguishment of new online courses to work on…concern over their own job security too. However, a different perspective on the issue might help instructional designers to support a pro-administration stance on copyright policies. If the institution is not able to recoup costs and make a profit on the online enterprise, their jobs are equally endangered. Perhaps the instructional designer can't win either way they go, but they have seen that the most immediate concern is over whether or not faculty will continue to engage in activities that are not financially or institutionally rewarded at the same levels as competing activities such as research, scholarship or private consulting.

If we can separate ourselves from the specific personal interests of each of these groups for their own job and income concerns, we can begin to look at the problem a bit more holistically, perhaps even a bit more systemically. All of the concerns voiced by all of the different parties are entirely legitimate. The question is what is most in alignment with the goals (historical or contemporary) of the institution of higher education. Advocates of online learning typically cite the importance of democratizing the university (CITE), opening access, and, in the case of land grant public institutions, the mission of outreach as primary goals for institutions of higher education. These are indeed important missions, however, they are very tentatively linked to the interests of administrators which are primarily around competition and income streams. While the rhetoric may focus on democracy, the policies do not. Policies that would focus on democratization would emphasize changes in incentive and reward systems within the university to more fully legitimize online learning development as important to the promotion and tenure process. Policies interested in furthering the reach of the university through online learning would not restrict faculty from offering courses online to any and all comers through whatever outlets were available and willing to invest the necessary resources. Instead, most administration policies assert the right of the institution to own the materials developed, essentially discouraging faculty from participating and lay out conflict of commitment clauses to minimize competition. This is borne of the self-interest of maintaining revenue streams within the institution. This may be seen by faculty as particularly aggregious in the context of large salary increases taken by upper administrators within their home institutions.

On the other hand, the faculty members are rarely working out of purer motives, even from a systemic perspective. The rhetoric many faculty members use to forward the agenda of creating online courses for competing organizations is the importance of academic freedom. The stronger rhetoric is actually founded on the basic goal and mission of higher education. In this case, the mission that is emphasized is the advancement of knowledge throughout the world. The open access through MIT's recent agreement to put learning materials online free of charge is an interesting case of living this mission out. No one is making money off of that initiative unless it is through the good will that is spread by returning to a nobler mission for higher education. It is quite possible that such an open access initiative may engender significant public support for public institutions of higher education, making the entire enterprise far more relevant than it has been for many years. When the mission is seen as advancement of knowledge, and sharing of learning and information as widely as possible, non-compete clauses come up far short and administrator copyright policies appear to be more interested in furthering the goals of a corporation than an educational institution.

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Creating "Technology Intensive" Courses Through Faculty Mentoring

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Abstract

The College of Education (COE) at the University of Hawaii (UH) has already begun to create an infrastructure to systematically infuse technology into its curriculum through a new designation of "Technology Intensive" courses. The primary goal of this project was to prepare future teachers to integrate technology into instruction through systematic reformation in the teacher preparation programs. To meet this goal, faculty members in the COE and their pre-service students are being mentored by graduate students to model technology integration. The newest generation of this project is referred to as "LEI Aloha," which stands for Learning Enhancement through Innovation.

Project Need

The electronic revolution has created new means to present information with equipment such as digital video and multimedia authoring software. What is currently lacking, however, is the professional development and expertise in the usage of these tools in today's classrooms. Faison states that United States (US) Office of Technology Assessment (OTA) has concluded that the most direct and cost-effective way to train teachers about technology is through pre-service teacher education courses. The question then is how do we train faculty to be technology role models?

A technology needs assessment of the University of Hawaii at Manoa (UH) College of Education (COE) faculty was conducted by Ho, Sherry, Speitel, & Walton (1999) to find out how technology was being used to identify the training needs of faculty, and to provide recommendations for the future growth of technology applications in the COE. The survey was based on the guidelines of the National Council on Accreditation of Teacher Education (NCATE) and International Society for Technology in Education (ISTE) standards for technology within education.

Overall, it was found that there was a discrepancy between the use of technology for teaching and the use of technology for professional activities. Faculty and students commonly used email, word-processing, and on-line information for their scholarly work but much less frequently for teaching and learning.

It was interesting that students' use of technology mirrored that of faculty, but they used technology less frequently than faculty. This result demonstrates how important faculty are as role models to students. "After all, faculty model the use of technology applications in their courses. Also, faculty provide opportunities for students to use technology...". Since students were rated lower on technology use, it suggests that faculty are still not providing adequate technological opportunities when designing their courses. This may be because the integration of technology into teaching is more difficult than personal use of technology.

This report confirmed the need for a continuing effort to solve this problem. Five years ago the authors developed such an effort in a program to provide professional development for a new designation of "technology intensive" courses. The program provides focuses primarily on technology workshops and one-on-one mentoring assistance for faculty.

Standards and Guidelines

A 1996 pilot project was funded by the University to develop a general designation of "technology intensive" courses that could be used university-wide. The type of impact desired called for an expansive, long-term project thinking on the question of "what should our graduates know?" With the leadership of Fulford and Hines (1997), a committee of faculty members from a broad range of subject areas developed a set of technology intensive standards for the development of the courses.

The Technology Intensive Standards were derived from three sources: the UH General Education Standards, the United States Education Secretary's Commission on Achieving Necessary Skills (SCANS) Report, and the International Society for Technology in Education (I S T E) Standards for Basic Endorsement in Educational Computing and Technology Literacy.

The standards include six categories: ethics, operations, analysis, retrieval, application, and attitudes. The six categories cover 35 specific standards. The standards development team provided an explanation of each category's purpose.

The technology-intensive guidelines were established by Fulford and the committee (1997) to provide information for faculty on course development. The idea is that technology should help facilitate communication, problem solving, analysis, research, and presentation. However, the course subject matter would remain the same.

Faculty were expected to use at least one standard from each category since one course could not cover all the standards. The premise was that among the variety of courses students take, they would upon graduation have mastered these standards.

Faculty should model ethical standards as well as visual and instructional design techniques fundamental to learning with technology. Essential to all courses is the student use of technology including opportunities to create multi-media, web pages, videos, and electronic slide shows. Faculty are encouraged to discuss need for growth in technology with their students and to acknowledge issues of access, skill level, and anxiety.

Professional Development Workshops and Mentoring

Faculty in the project have been provided with ongoing professional development to effectively integrate technology into their courses. Each year the project began with professional development workshops. These efforts received help from the graduate students in an Educational Technology Practicum. In each session, experienced faculty and teachers in kindergarten-12th (K-12) schools showed examples of how they were integrating technology into their courses. These were followed by specific demonstrations of hardware and software.

The next half of each session was devoted to hands-on practice with the technology. Faculty professional development has included topics such as: course design, visual design, electronic conferencing, web page design, multi-media and video production, electronic presentations and portfolios, technology ethics and copyright, assessment of technology projects, one computer classroom strategies, and online collaboration.

Once faculty members have attended the workshop sessions they are recruited to create technology intensive courses. Faculty who express interest for integrating technology into their courses are offered one-on-one assistance to facilitate this process. Faculty are paired graduate students from the Educational Technology Department who work for the project. Typically, the pairs will meet on a weekly basis over a semester. These sessions usually last about an hour and take place in the faculty member's office. The ultimate outcome of the sessions is a course proposal in which the faculty member outlines the ways in which they have redesigned a course to incorporate technology using the technology intensive standards. The proposal also describes the ways in which the faculty member is modeling technology use, the ways in which the students are using technology, the specific hardware and software being used and any future technology needs of the faculty member. In order for the students to be able to effectively mentor the faculty toward this goal, an instructional design approach is used to: (a) set goals for the professional development; (b) provide expertise in creating a revised curriculum especially with regard to the technology-intensive standards; and (c) assist in improving technical skills to help faculty members reach their technology integration goals.

The overseeing project faculty member and experienced graduate students pair student mentors with faculty members based upon the technology areas in which the faculty member has expressed interest and the specific areas of expertise of student mentors. Compatible schedules and preferred computer platforms such as Mac or PC are also important. Once the pairs have been established, the student mentor contacts the faculty member to assess their technology needs and levels of confidence and experience. A survey developed by previous graduate students is administered to determine interest and experience with various software applications and digital technologies such as video and still imaging.

Once the student mentor has determined the technology skill and confidence levels of the faculty member, an initial session is scheduled. At this session, the mentor and the faculty member discuss the content of the course to be redesigned and the vision and goals the faculty member has for redesigning the course to integrate technology. The mentor must be tactful with the faculty member to be encouraging and yet realistic as to what can be accomplished in one semester. The pair discuss their respective time schedules and the amount of time the professor has to dedicate to the redesign process. A letter of agreement provided by the mentor is signed by the faculty member stating that a) the faculty memberacknowledges that the assistance will be provided throughout the semester, b) his or her involvement will include his or her participation and communication about the progress of the course, c) he or she will cooperate in the evaluation of the course by the grant project, and d) he or she agrees to be listed as a project participant on the project web site.

Student mentors need a number of skills in order to conduct one-on-one faculty mentoring. Not only do they have technology skills that they impart to the faculty but they also use instructional design knowledge to help the faculty member plan and organize the course to be redesigned. The goal of the mentoring is to assist faculty members to be independent, self-sufficient users of technology. To achieve this goal, students often need to know how to handle "sticky" situations. Examples of "sticky" situations include faculty members expecting the mentor to do the technology work for them, faculty members not completing work they have agreed to do in order for the sessions to proceed, chronic appointment cancellations, and faculty who are continually distracted by new media and stray off topic every week.

In order to conduct one-on-ones and to handle these situations, incoming graduate students who are hired to work one-on-one with faculty must be properly trained. Training students to be mentors is organized by an overseeing project faculty member and conducted by graduate students who have mentoring experience. These cross-training sessions, where students train each other, are held early in the semester.

The most fundamental of the cross-training sessions conducted is "how to conduct one-on-ones." In this session trainees are introduced to a packet of materials created by project staff and students to assist both the faculty member and the student mentor with the one-on-one sessions. Included in the materials packet is the technology needs survey, the letter of agreement to be signed by the faculty participant and the student mentor, a copy of the technology intensive standards, and examples of the types of materials a mentor may want to use to keep their sessions organized and on track, such as lists of questions for faculty members, sample agendas and suggestions for how to keep sessions focused.

Essential features of this training session are role-playing and activities in which the new mentors are asked to come up with solutions to "sticky" situations. The first activity uses a series of written scenarios. New mentors are paired up and asked to read the scenarios, come up with solutions and provide and receive feedback on the solutions with the rest of the group. The second activity involves role-playing. Experienced graduate students act out skits of problematic one-on-one sessions and ask for feedback on various solutions. Feedback from new mentors has been positive about the role-playing and scenario problem solving. They report that it gives them a better idea of what to expect and how to handle a variety of situations. Experienced graduate students are asked to share their specific experiences conducting one-on-ones and provide helpful hints and practical tips for success.

Another cross training session conducted for incoming mentors is on the technology intensive standards. Experienced graduate students report that one of the most complicated parts of one-on-one mentoring is helping the faculty understand how to incorporate the standards into the redesigned course. The ETEC faculty member who headed the standards committee is usually asked to conduct this workshop. The faculty member gives a brief history of the standards project including how and why they were developed. She also goes over each standards category in detail and provides specific examples from previous proposals on how a standard was incorporated into a technology intensive course.

A third cross training session is provided to incoming student mentors on customer service. As representatives of the grant project and the Educational Technology Department providing a service to the college, the student mentors are expected to project professionalism, helpfulness and a positive attitude. This session goes over basics of positive communication, attentive listening, courtesy with fellow workers and customers as well as telephone behavior.

These cross-training sessions compliment the technology-based sessions conducted on a more informal basis by the students working for the project. The faculty member overseeing the one-on-ones and a graduate student organize cross-training sessions to be conducted by ETEC graduate students with specific knowledge in software or hardware. For example, ETEC graduate students have conducted cross-training on web design using DreamWeaver and Claris Home Page, advanced features of MS Word, how to use equipment such as data projectors, digital video and still cameras, effective web searching, digital video editing, WebCT and how to construct PowerPoint presentations.

The one-on-one sessions have provided individualized assistance in the same fashion as mentoring relationships. According to Archer (1999) many teachers are not confident in integrating technology into instruction. Based on project evaluations, mentoring faculty members through the one-on-one sessions has vastly improved confidence levels of the COE participants who have already created technology intensive courses.

NCATE (1999) suggests that mentoring and providing feedback is an effective method of professional development in technology integration. A train-the-trainer effort was implemented so those faculty members provided with professional development would also serve as mentors to K-12 faculty. Thus far, 17 general education faculty and 23 full-time COE faculty and 3 instructors have been involved in the project.

Response and Impact

Faculty involved in the project have been positive in their feedback about the workshops and especially the one-on-one mentoring. Surveys and interviews reflect that the most popular form of course redesign assistance is the one-on-one session. Faculty report that while the workshops increase their technology skills, the one-on-ones meet their particular needs and are where they can truly concentrate on their own course redesign. The value of one-on-one assistance is perhaps most evident in the in-service teacher training program launched about the same time the technology intensive training program was being implemented in the College of Education. The Professional Diploma in Education (PDE) program, as a distance education program targeting teachers in rural areas on Oahu and neighbor islands, relies heavily on electronic media, particularly web- based delivery and email communication, and to a lesser degree interactive TV. It was largely due to one-on-one mentoring that the PDE faculty was able to overcome their initial difficulties with Web CT to launch the distance education program.

While the technology intensive mentoring has been highly successful, there are instances where one-on-one sessions have not been successful. Sometimes these cases arise due to mentor-faculty incompatibility. These instances provide valuable insight into program improvement. For instance, a faculty member purchased a complicated statistical software program and wanted to incorporate it in their personal research and statistics coursework. None of the student mentors were familiar with the program. A student mentor attempted to learn it but was also not familiar with statistics and felt that the amount of time it was taking to grasp the program was not well spent based on his limited progress. The faculty member was encouraged to consult with another professor versed in statistics and in this particular software. While most student mentors are familiar with both computer platforms, Macintosh and PC, a situation arose where hardware problems a faculty member was have having with a Mac could not be solved by the student mentor who was more familiar with PCs. Situations like this are referred to other mentors or the Information and Technology Services Department on-campus.

Situations have also arisen where a faculty member has signed up for mentoring and had intentions of redesigning a course but then find they are too busy to add additional work to their load. Mentors may have been told this up-front or may have discovered it gradually through chronic postponing or cancellation of one-on-one sessions. Although faculty may be enthusiastic about redesigning their courses to be technology intensive, some may not be ready to completely redesign their courses. The expansion of the technology intensive project has addressed this challenge through a three-tiered approach to course redesign.

Project Expansion

Although the project has been highly successful, only a third of the College of Education faculty that work with pre-service and in-service teachers have been trained. Two challenges facing the project group are how to recruit faculty members still reticent about using technology and how to provide a continuum of technology intensive courses throughout a COE student's schooling from the Community College level through to their field-based experiences. Continued federal funding from the US Department of Education's "Preparing Tomorrow's Teachers to Use Technology" program (PT3) has allowed the project to expand to meet these needs. The newest project (PT3) is referred to as "LEI Aloha" - Learning Enhancement through Innovation.

To meet the challenge of reluctant faculty, the LEI Aloha staff has developed a three-tiered approach to support the needs of teacher education courses.

Technology Intensive Courses:

These courses follow the Technology Intensive Standards and Guidelines to improve technology literacy while continuing to emphasize course content. Students have a high level of involvement using technology, while faculty meet standards as exemplary role models using technology. In this process faculty need assistance in rethinking and redesigning their courses to integrate technology. They will have to revise course objectives, create new strategies and activities, locate and create new media, and develop alternative assessments.

Technology Applied Courses:

These courses add the use of technology to the current course structure encouraging students to use technology resources in their research, communication, and presentations. The faculty member demonstrates and uses technology in the presentation of course content and communicates with students electronically. Faculty need help to become familiar with and use the multitude of alternatives that technology provides.

Technology Enhanced Courses:

In these courses, the faculty member demonstrates and uses technology in the presentation of course content and communicates with students electronically. Faculty need to become proficient with redesigning their course presentations and using electronic communications.

To meet the second challenge of a continuum of technology intensive courses throughout a COE student's schooling, the project has expanded its mission to include Community College faculty. A majority of COE students have taken courses prerequisite to the COE at the Community Colleges. For many students, Community College faculty members provide the introduction to a college career and have a great influence on how students begin to shape their view of the teaching and learning environment. LEI Aloha is currently working with each of the seven community college campuses of the UH system to create technology intensive courses at all the campuses.

While the first components of the educational continuum are the community college and COE faculty, the final component are K-12 teachers who serve as mentors to students in their field experiences. These teachers play a vital role at a critical time in students' careers. Hinnant (1997) states that "the elements most crucial to the successful integration of technologies into teaching are teachers and their ability to use all their skills to inspire, motivate, challenge, and enrich their students (p. 1)". In these field experiences, students see first-hand whether and how technology can be integrated into the K-12 school environment. Positive role models are crucial at this juncture.

The LEI Aloha project is developing a series of web-based technology intensive teacher education courses. These courses are being offered in conjunction with a technology intensive sabbatical opportunity for K-12 teachers. The program will train in-service teachers to be technology mentors to pre-service teachers completing their field-based, student teaching requirements.

This project has been designed to create a broad ranging impact. It is based on the concept of mentoring and training-the-trainer to integrate technology. COE students are expected to become teachers who will provide their own students with the benefits of their knowledge. This will create a multiplier effect so that in just a few years, including the students of students, thousands of students will be affected.

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Trek 21: Building Teachers' Capacity To Develop IT-Integrated Units With Student Engagement

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Abstract

Trek 21 is a 3-year PT3 implementation grant from the United States Department of Education designed to build the capacity in teacher educators (teacher education faculty, Professional Development School faculty, pre-service interns) to integrate technology into their teaching. The goal of Trek 21 is to prepare educators to use and integrate instructional technologies (ITs) for teaching and learning. This paper discusses shifts in the development between year one and year two of teachers' web-based instructional units, with a focus on the degree to which year two units feature greater student engagement using networked technologies. Through a detailed discussion of project events and participant outcomes, strategies of the Trek 21 Model of Professional Development process are illustrated.

Introduction

The National Commission on Teaching and America's Future (1996) asserts that pre-service teacher education has the potential for the greatest influence in enhancing the learning opportunities of children. The report goes on to state that excellent pre-service teacher education requires bringing together the contexts of schools with the preparation of teachers. This preparation must be adequate and sustained in the professional practice of teachers.

Current instructional technologies offer students and teachers access to information and multiple modes of knowledge construction. By design, these new technologies make this method of knowledge construction largely individualistic and demand changes in teaching and learning environments so as to effectively integrate them into the instructional process. It is essential for new teachers (pre-service) to develop new perspectives on instructional design and new instructional technology skills within settings and environments in which these approaches are modeled. Students exiting teacher preparation programs must have acquired the ability to integrate new and future instructional technologies, and must have gained the skills necessary to adjust to teaching environments where limited technology infrastructure and capacity exist.

Preparing Tomorrow's Teachers to Use Technology (PT3) and Trek 21

PT3 is an initiative of the United States Department of Education. Grants from the PT3 Initiative provide funding for innovative programs to develop technologically proficient educators who are well prepared to meet the needs of 21st century learners. "Trek 21: Educating Teachers as Agents of Technological Change" is a 3-year PT3 implementation grant from the U. S. Department of Education designed to prepare educators involved in West Virginia University's five-year teacher preparation program to integrate instructional technologies (ITs) into their teaching. The grant was awarded to the College of Human Resources and Education at West Virginia University (WVU) in 1999.

The Trek 21 model of teacher professional development includes host teachers in West Virginia University's Professional Development Schools (PDS), faculty from WVU's College of Human Resources and Education (HR&E), and student interns in their fifth year of the teacher preparation program. Trek 21 looks to impart lasting change in the culture of teacher practice. To help accomplish this change, the design of the Trek 21 model includes an annual cycle of professional development events: Summer Institutes for WVU faculty (seven days) and PDS teachers (three weeks), school site visits, mini conferences, and continuity meetings in the fall and spring.

Project Design

The Trek 21 model is an annual cycle of events sequenced in such a manner so as to ensure long-term adoption of new practice, continuous support and feedback, and sustainability beyond the project.

Summer institutes

A seven-day technology integration summer institute for university faculty and a three-week technology integration summer institute for PDS host teachers begins each year of the Trek 21 project cycle. These Institutes address genres of instructional technology applications (Harris, 1998), target technical training, and prepare instructional technology materials and resources necessary for immediate integration into classroom instruction. The final outcome is a teacher-developed, web-based instructional unit, which is implemented in the fall by the teacher in collaboration with a pre-service student intern.

Continuity meetings/site visits

Following the summer institutes, Trek 21 holds continuity meetings with PDS faculty once each semester (fall and spring) to address issues related to the successful integration of instructional technologies at their location. School site visits occur throughout the year to provide continued support and gather data on unit implementation and local concerns.

Mini conferences

Scheduled to occur twice each academic year, a mini-conference is held in partnership with West Virginia's "Technology, Teacher Education, Tomorrow" (T3) non-profit organization whose mission is to share best practices, receive technology enhancement training, and deliver presentations of activities related to the integration of instructional technologies. These conferences serve as our opportunity for state-wide dissemination of Trek 21 research results and presentation by participants of best practice where the integration of ITs is central.

Summary of Year One Events and Outcomes

Participants for the first year included 47 PDS teachers who supervised pre-service interns during the fall semester. Of the 47 teachers, 17 were elementary school teachers, 19 were middle school teachers, and 11 were high school teachers. These teachers attended one of three summer institutes, each lasting three weeks. The Trek 21 Professional Development process for year one has been examined along multiple foci and reported (Adams, Dunham, Wells, & Shambaugh, 2001). Initial findings profiled K-12 participants as preferring a teacher-centered approach, providing minimal written details in lesson plans, and depicting themselves as low-level computer users with minimal integration levels of instructional technology. Analysis of lessons submitted by teachers at the beginning of the PDS Summer Institutes revealed 30% (14) of the teachers had a complete lesson(s), 32% (15) had some lesson plan features, and 38% (18) did not have a lesson plan.

An externally developed rubric guided the evaluation of participants' units, which resulted in an initial low percentage of posted teacher units. Following subsequent revisions during the fall continuity meeting, all teachers' units were posted to the Trek 21 web site. The web-based units were typically structured as teacher sites, with a limited number distinguishing between teacher and student activity. During year one, not enough emphasis was placed on the development of student-centered units and, as a result, learning activities were frequently depicted in lessons using traditional teacher-centered approaches. Although some ITs were integrated, particularly chat rooms and web boards, initially the units lacked the procedural details needed in order for other teachers and students to utilize them as the participants intended.

The most frequent learning strategies employed by teachers in their units involved a) problem solving using information retrieval and desktop publishing technologies, b) concept scaffolding with PowerPoint presentations and the Internet, and c) discovery learning through information retrieval and Internet searches. IT applications most utilized by teachers were presentations (32 activities), information retrieval (29), and Internet searches (17).

Final evaluations of teachers' web-based units indicated web design was an area that needed to be more fully addressed early in the development process. The most frequently occurring web design issues were: providing needed structure for the learning activities and information to communicate the overall intent, giving individual lessons descriptive titles, reducing scrollable text, documenting individual lessons on separate pages, reducing animated GIFs, improving background/text contrast, addressing web browser differences, providing appropriate navigation and consistent use of navigation icons. Addressing these issues with teachers earlier in the development of their web units would provide the design and software foundation they needed to design well from the start.

The first year of professional development with PDS teachers revealed the need to provide teachers with a clearer picture of the overall intent of their web-based unit. For some participants, translating what they currently do in the classroom into web-based student-centered activities was a major shift. Feedback from the summer 2001 institutes indicated that providing greater clarity in our expectations of teachers, their obligations and responsibilities, would markedly improve the instructional outcomes of the project. Furthermore, year one findings indicated that by more clearly defining terms such as "lesson" and "unit", incorporating strong examples of lesson templates, and providing consistency between the evaluation tools and instructional strategies employed, the professional development process would improve.

The importance of sufficient staff, proper facilities, and ample time is well understood. During the Trek 21 professional development process teachers expressed the need for as much time as possible for unit development. In addition year one feedback revealed that during the development time teachers require both consistently available technical assistance and sufficient pedagogical expertise as it relates to the instructional technologies integrated. This demand for both technical and instructional expertise presented a significant staffing challenge during year one institutes.

Year Two Design Changes

Based on year two experiences, design changes were implemented to address specific preparation and training areas in need of improvement. Improvements such as clearly conveyed expectations, using common terminology understood by all participants, and indicating that units would consist of a minimum of five lessons enabled teachers to plan well for the institute. Their planning was also improved by asking them to submit units they had taught many times before, they felt very comfortable with, and that they would be teaching in the fall.

Re-designed unit/lesson templates provided participants with a consistent structure and common terminology upon which all their units could be developed and evaluated. The significance of the re-designed templates was the way they guided teachers toward separation of student and teacher activities, helping to emphasize the goal of creating student-centered lessons. As a result, prior to arriving at the summer institute most of the participants' units were pedagogically complete and more ready for instructional technology integration. To address some of the web design issues found to be problematic in year one, participants were encouraged to begin their web page development using Trek 21 pre-designed web page templates. These web page templates included invisible tables, and contained consistent design and navigation features that enabled participants to concentrate on the application of instructional technologies rather than web page design. Participants were evaluated using a detailed, internally developed rubric that aligned directly with requirements designed into the unit/lesson and web page templates they all used when submitting application.

The evaluation of year one institutes identified the need for classroom expertise during training, which led to the incorporation of prior teacher participants as Instructional Leaders (ILs) as part of the Trek 21 Professional Development process. The Instructional Leaders served as master teachers to help ground the summer institutes by assisting new project participants with pedagogical issues, and by providing them with details on how to incorporate the three genres of instructional technology known to promote student engagement (Harris, 1998). The presence of Instructional Leaders allowed other Trek 21 personnel to focus on technical support, and resulted in the inclusion of additional (optional) breakout sessions to meet the diverse needs of novice, intermediate, and expert participants.

The Trek 21 cycle of events includes fall and spring continuity meetings and informal site visits in an effort to provide opportunities for further skill development and technical support. Each continuity meeting offers a full day of development time for teachers to revise their units with the convenience of a support staff readily available to provide assistance. The arrangement of informal site visits throughout the year allows Trek 21 staff members to visit each school for follow-up sessions with participants, assisting participants with problems and becoming familiar with their classroom environment. Additionally, selected project participants and Trek 21 staff members serve as part of a Trek 21 Leadership and Planning Committee, which reflect on prior institute processes and offer suggestions for revision.

Summary of Year Two Events and Outcomes

Participants in year two consisted of 27 teachers selected from the Professional Development Schools within the five West Virginia counties included in the Trek 21 project. This group was comprised of two preschool teachers, 17 elementary school teachers, four middle school teachers, and four high school teachers. These teachers attended one three-week long Summer Institute. Information collected from a self-reporting survey indicated that the participants' technological skill levels varied from novice computer users to expert computer users.

Random sweeps and select comprehensive evaluations of the pre- and post-institute lessons illustrated the extent of student engagement in units. Although teachers' objectives and methods of assessment were not changed by technology integration, modifications were apparent when comparisons were made between pre- and post-institute lessons. Active student engagement in instructional procedures, instructional strategies, and integration of instructional technologies increased significantly in post-institute units, reflecting an increase in student-centered lesson design. For example, active student engagement included overt responses to instructional prompts such as sequencing cards, responding verbally in writing, retrieving information from a web site, and participating in discussion. Units developed during the summer 2001 institute clearly indicate the development of learner-centered units where student engagement was encouraged via the application of instructional technologies. Evidence of changes to instructional procedures included the existence of a motivating introduction, review information, new content, guided practice, independent practice, closure, and extensions. Changes to instructional procedures also included active student participation in procedures for student-centered activities located within teachers' units. Indicators of change in instructional strategies took the form of advanced organizers, whole group instruction, peer-mediated instruction, group discussion, active responding, problem-solving, research, inquiry, hands-on instruction, manipulatives, dramatic representation, journaling or writing, student presentations, or teacher demonstrations. Most participants included detailed information on the unit web pages on how to apply the instructional strategies in order to promote student engagement in the unit. Similarly, improvements in IT integrations involved extensions to activities such as Computer Aided Instruction drill-and-practice, simulation, educational games, word processing, information retrieval, internet access, e-mail, bulletin boards, listservs, authoring, multimedia development, desktop publishing, electronic presentations, video development, open lab access, or web page development. Overall, instructional technologies integrated by teachers provided a variety of avenues that promoted student engagement and participation in unit lessons.

In addition to meeting the need for greater assistance with project participants during the institute, Instructional Leaders guided participants on approaches to effective student engagement and the enhancement of teaching and learning via instructional technology. Because sufficient staff and facilities were available, participants were afforded flexible technical training whereby they could select individual IT training sessions based on integration potential within their unit lessons. By and large, Trek 21 participation resulted in unit modifications by teachers that unmistakably reflected strong student-centered lessons.

Implications for Year Three

Based on the overall results from years one and two, minor refinements will be incorporated into the design of year three to improve the Trek 21 Professional Development process. These refinements include clearer benchmarks pinpointed throughout the institute, perhaps in the form of a checklist, so participants can manage the amount of time spent on each section appropriately. Minor revisions to project documents such as the evaluation rubric and the unit/lesson templates will provide more precise guidelines for development. By offering concise directions and consistent expectations for all personnel involved in the project, participants will be more prepared to create web-based instructional units that integrate instructional technologies appropriately for student engagement.

Implications for year three focus on expanding the number of ITs by offering additional (optional) breakout sessions. During the first two days of the institute, exemplars will be identified that better illustrate the educational purpose of instructional technologies that will be offered throughout the institute. Teachers will be encouraged to choose from a pedagogical standpoint the instructional technologies they want to learn and integrate into their lessons. This will allow the participants to set their own limits on the new knowledge gained throughout the institute, so they are not overwhelmed with new possibilities.

Conclusions

The design of professional development with instructional technology as a focus is complex and requires clear guidelines, continual communication, and flexibility to meet individual teacher needs. The existence of clear instructions, consistent objectives, and defined expectations contribute to the overall success, particularly in the area of active student engagement. Factors such as collaboration with instructional leaders, the development of a Leadership and Planning Committee, and the use of an evaluation rubric by external reviewers have all led to the specification of clear and distinct roles and appropriate support mechanisms for project participants. Requiring teachers to submit a unit with a minimum of five related lessons prior to the institute allowed us to begin the institute with illustrations and demonstrations of appropriate student engagement on unit web pages.

Results from the Trek 21 model of Professional Development clearly indicate an effective process for the development of learner-centered units facilitated through the integration and application of instructional technologies. Preliminary findings suggest that the implementation of Trek 21 participants' units will enhance student engagement in the instructional strategies, procedures, and integration of instructional technologies.

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Individualized Instruction: An Integrated Approach

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Abstract

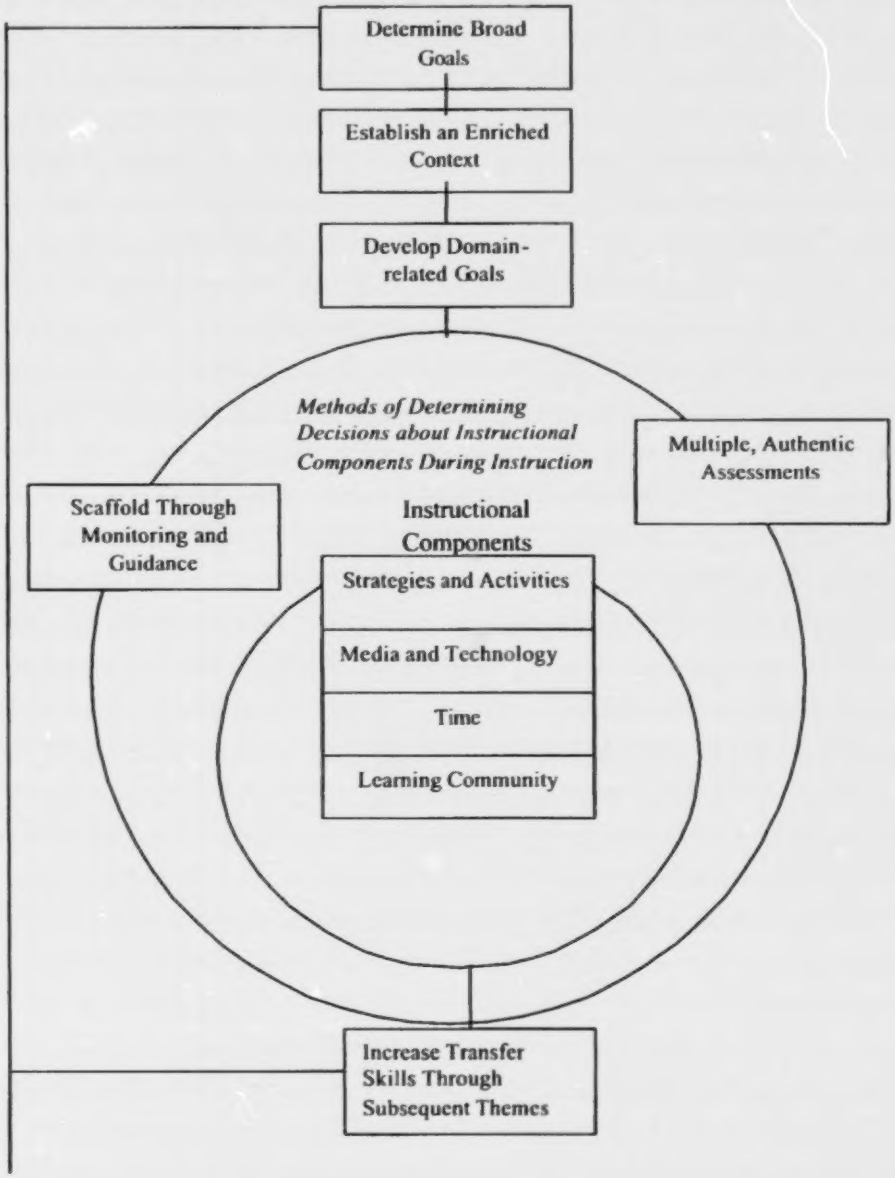
To prepare diverse learners for various roles in life, teachers should develop contextualized learning environments that enable students to develop individual skills while contributing to the knowledge of the classroom community. This is accomplished by integrating various subject matter domains with interdisciplinary themes that incorporate real-life roles and contexts. This paper provides a framework for designing and implementing integrated units that address the needs of all students.

Introduction

As K-12 classrooms continue to diversify, it becomes increasingly important that teachers structure learning experiences to meet the individual needs of all students. Many students cope with learning and emotional disabilities, economic challenges, and limited English proficiency. Instruction must be designed to engage such students while appealing to multiple learning styles and those who are gifted. Instruction is more meaningful for students as they progress through material that is presented in an integrated, individualized manner. The challenge is to promote learning and inclusiveness by engaging and scaffolding students with varying abilities. This is accomplished through thematic, integrated lessons that utilize various media and technologies. Literature on learning theories informs the development of such student-centered environments. Experts in the fields of learning, cognition, and instructional-design suggest approaches that serve as guidelines for tailoring instruction to meet the needs of all students so that they may participate to the fullest extent possible and progress to increasingly higher levels of expertise. Drawing upon theory, such instruction may be designed by utilizing the steps listed below and displayed graphically in Figure 1.

Determine broad goals
Establish an enriched context
Develop domain-specific goals related to the context
Use multiple, authentic assessments as a base line for developing individual learning experiences
Use a variety of strategies and activities that address diverse learning styles
Provide a variety of media and technology to individualize learning
Scaffold through constant monitoring and guidance
Allow time for student work to be self-paced
Encourage a learning community that values the input of individuals
Extend learning and transfer in subsequent themes

Figure 1. Model for Designing and Implementing Integrative Thematic Unit for Individualization


Determine Broad Goals
Establish an Enriched Context
Develop Domain-related Goals
Methods of Determining Decisions about Instructional Components During Instruction
Multiple, Authentic Assessments
Scaffold Through Monitoring and Guidance
Instructional Components
Strategies and Activities
Media and Technology
Time
Learning Community
Increase Transfer Skills Through Subsequent Themes

Determine Broad Goals

The first step in designing an individualized, integrated learning environment is to identify the broad picture and goals of society (Harless, 1998). If the ultimate outcome of education is to produce accomplished citizens, then instructional goals must move beyond a subject matter orientation. Rather than developing lessons to teach in response to segregated math, science, and language arts goals, planning should first address broader goals that equip students with the skills, knowledge, and attitudes that will prepare them for various roles in society (Harless, 1998, p.48). Once those broader goals are developed, the teacher may translate them into smaller competencies (Gagne, Briggs, & Wager, 1992 pp. 145-184). Reigeluth's (1999) Elaboration Theory advocates beginning with broader topics within a domain and then progressing to more detailed principles, which provides a sequence that "enables learners to understand the tasks holistically" (p.433). Reigeluth further explains that this type of instruction allows students to develop a schema, which can be expanded through subsequent lessons. Addressing subject matter goals through a rich, integrated, contextualized environment facilitates making meaning and connections of new knowledge.

Establish a Context

Providing an enriched environment that includes adequate resources and is based upon relevant topics that emphasize real people and places engages and sustains interest (Kovalik 1997; 1999). For example, a fifth grade classroom begins a two-week unit with an around-the-world theme. When the students enter the room on the first Monday of the unit, they find maps, newspapers, pictures, and other artifacts representing various regions from around the world lining the walls and tables of the classroom. Students instantly become immersed in a contextualized environment, which will engage them in activities that promote deeper understanding of people and cultures of the world. These learning experiences will prepare students to become global citizens.

The teacher begins by reading *Letters From Felix* (Langen & Droop, 1994) aloud to the students. This story is about a stuffed rabbit named Felix who gets separated from his owner, Sophie at an airport. Felix boards numerous planes and travels around the world to several countries as he tries to find his way back home to her in Ohio. As Felix stops in each country, he writes a letter to Sophie and includes descriptions, drawings, and pictures of what he sees. As Sophie receives each letter, her family discusses characteristics of the described country. The book has envelopes with pullout copies of these letters. This story sets the context for learning activities and motivates children to learn more about other cultures and regions.

Develop Domain-Specific Goals

As students take on the role of global citizen during the unit, they develop a greater understanding of their world and develop skills in specific subject areas in meaningful ways. Math, science, social studies, art, language arts, and technology objectives easily emerge and skills are applied in realistic ways. Math goals are addressed as students learn to measure and calculate distances traveled; compare and contrast data; use calculators to compute travel budgets; and add, subtract, multiply, and divide numbers with decimals. Science goals are addressed as students discover global weather patterns and landforms. Learners apply the scientific process as they conduct local weather experiments and compare data with other cities. Social studies goals are attended to as students develop an understanding of diverse cultures, places, and environments. Art goals further such understanding as students study art and artifacts of cultures. For example, students may discover that artists Vincent Van Gogh of the Netherlands, Diego Rivera of Mexico, and Faith Ringgold of the United States all spent time in Europe and created paintings of sunflowers. These kinds of patterns promote dialogue about similarities and differences among countries.

As students use the Internet, software, and word processing to gather and express information, they become proficient in the use of technology, which is in alignment with national technology goals. Language arts goals thread these content area goals as students read, research, speak, and write about global information. Students read a broad range of fictional and non-fictional texts to promote understanding. Regional poetry, music, and folk literature enrich data gathered from encyclopedias, newspapers, and maps. Refer to Figure 2 for an abundant list of goals addressed in this particular unit.

Figure 2. National Standards Addressed in this Scenario

National Standards Addressed in this Scenario

SCIENCE

National Science Education Standards

http://www.nap.edu/readingroom/books/nses/

Students develop understanding of populations, resources, and environments.

Students develop understandings about scientific inquiry.

Students develop abilities necessary to do scientific inquiry.

SOCIAL STUDIES

National Council for the Social Studies

http://www.socialstudies.org

Students develop understandings of cultural diversity.

Students develop understandings of people, places, and environments.

Students develop understandings of global connections and interdependence.

MATH

National Council of Teachers of Mathematics

http://www.nctm.org

Students understand various meanings of multiplication and division.

Students understand the effects of multiplying and dividing whole numbers.

Students develop fluency in adding, subtracting, multiplying, and dividing whole numbers.

Students understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.

Select and apply appropriate standard units and tools to measure length, temperature, etc.

Students collect data using observations and experiments.

Students solve problems that arise in mathematics and other contexts.

Students organize and consolidate their mathematical thinking through communication.

LANGUAGE ARTS

National Council of Teachers of English

http://ncte.org

Students read a wide range of print and nonprint texts to build an understanding of texts, themselves, and of the cultures of the United States and the world and to acquire new information. Among these texts are fiction and nonfiction.

Students read a wide range of literature in many genres to build an understanding of many dimensions of human experiences.

Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

Students conduct research by gathering, evaluating, and synthesizing data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

Students use a variety of technological and information resources to gather and synthesize information and to create and communicate knowledge.

Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, persuasion, and the exchange of information).

ARTS
National Standards for Arts Education
http://www.didaxinc.com/standards/artstandards.html

Students relate various types of arts knowledge and skills within and across the arts disciplines. This includes mixing and matching competencies and understandings in art-making, history and culture, and analysis in any arts-related project.

Students develop and present basic analyses of works of art from structural, historical, and cultural perspectives, and from combinations of those perspectives. This includes the ability to understand and evaluate work in the various arts disciplines.

Students communicate at a basic level in the four arts disciplines—dance, music, theatre, and the visual arts. This includes knowledge and skills in the use of the basic vocabularies, materials, tools, techniques, and intellectual methods of each arts discipline.

TECHNOLOGY
International Society for Technology in Education
http://cnets.iste.org

A. Students are proficient in the use of technology.

Students use technology tools to enhance learning, increase productivity, and promote creativity.

Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

Students use technology to locate, evaluate, and collect information from a variety of sources.

Students use technology tools to process data and report results.

Use Multiple Authentic Assessments

Individualizing instruction is necessary so that *all* students can participate in this unit. If, for example, the reading levels of this fifth grade class range from first to seventh grade, one textbook would not be at an appropriately challenging level for all. Teachers must choose appropriate media and technology to scaffold learners with varied abilities. According to Vygotsky (1978, p.86), each student has a zone of proximal development, which is "the distance between actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." In order to determine the student's beginning point of his/her zone of proximal development, teachers should use multiple forms of authentic assessments. The unit's contextualized activities serve as tasks for assessment. Frederikson & Collins (1989, p.31) advocate that tasks "included within an assessment system would vary from structured tasks that measure students' understanding of critical concepts or skills to open-ended tasks that allow students to demonstrate special knowledge and creativity". The many open-ended products throughout this thematic unit provide information about the reading levels, learning styles, strengths, and weaknesses of students that further inform media, technology, and strategy selection during the unit and in subsequent units.

Use a Variety of Strategies and Activities that Address Diverse Learning Styles

Humans in all cultures use multiple intelligences to solve problems and to create products (Gardner 1983). Gardner's (1999) intelligences include verbal-linguistic, math-logic, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist. Students may be more developed in certain areas, but should have the opportunity to strengthen all intelligences. The eight intelligences should be considered when developing lessons. A variety of teaching and learning strategies can be used to facilitate the development of the intelligences throughout any unit. Refer to Figure 3, which details the ways the multiple intelligences are addressed in this context.

Figure 3. Activities Within Each of the Multiple Intelligences

	Math	Science	Social Studies	Art	Language Arts
Verbal-Linguistic	Discuss budget	Read, write, and report on findings	Read, write, and share orally	Read and write about art/artists; discuss	Read, write, discuss
Math-logic	Compare/ contrast distances, compute travel budgets	Identify global weather patterns; compute average temperatures, rainfall, etc.	Further understanding through dates, distances, etc.	Understand art periods through timelines, etc.	Classify data for reports and projects
Spatial	Use maps to gather data	Read weather maps and charts	Use maps, timelines, and other visuals	Critique and create art	Use visuals (in addition to text) to gather information
Bodily-Kinesthetic	Use manipulatives to explore concepts	Use weather instruments to gather data; conduct experiments	Role-play: make a travel commercial and videotape; create interactive projects (envelope reports, rabbits, etc.)	Create art pieces	Learn through hands-on activities
Musical			Listen to national anthems and regional music	Listen to music that coincides with the time period of an art piece	Further understanding of cultures through poetry and music
Interpersonal	Work collaboratively to solve problems	Work cooperatively with others to locate and analyze data	Work with others	Relate to others through art	Cooperate with others
Intrapersonal	Work independently to solve problems; work at own pace	Work independently; work at own pace	Work independently; work at own pace	Express oneself through art	Work independently and at own pace
Naturalist		Explore weather patterns and collect data outdoors		Use live objects and the outdoors when creating art	

Provide a Variety of Media and Technology

Media and technology are powerful tools in aiding a teacher in individualizing instruction. Media may be selected so that each student is working within her zone of proximal development. Multimedia programs increase acquisition and retention of information by enlisting a variety of senses as students gather data visually and aurally. Technology has a dichotomous role in individualizing instruction because it gives students control over their learning and adapts to their responses accordingly.

After *Letters From Felix* (Langen & Droop, 1994) is read and discussed, students label maps and chart Felix's path of travel. Then, students form heterogeneous groups to further research one of the countries he visited. Knowing the reading levels is critical for this activity. Books about countries that are written with larger print, provide more pictures, and use simpler sentence structures scaffold lower-level readers. The series that includes *Postcards From Russia* (Arnold, 1996) and *Postcards From Mexico* (Arnold, 1996) serve this purpose. Books that have more sophisticated vocabulary and sentence structure, such as *The Portable World Factbook* (Lye, 1995), are more appropriate for higher-level readers. These books, in conjunction with software, scaffold group members as they refine their research skills and seek details about their assigned country. The groups use IBM's *World Book Millennium 2000* CD-ROM to quickly locate pictures, music clips, timelines, and maps. This software is motivating, appeals to diverse learning styles, and enables students to quickly access detailed information about related topics by linking to other articles on the disk's encyclopedia. The plethora of visual information allows children with limited English proficiency or learning disabilities to gather data without having to rely on text.

Scaffold Through Monitoring and Guidance

The teacher serves as a guide through this research process and as Jonassen (1999, p.230-6) describes, may provide modeling and coaching to further scaffold learners. The teacher may demonstrate note taking, highlighting, concept mapping, and software usage. As students work, the teacher monitors and informally assesses progress. Students apply their new knowledge about their country by writing a detailed letter to Sophie from the perspective of Felix. Writing on transparencies facilitates sharing, as the letters can be projected onto a larger screen. Groups may use a combination of text and drawings, as Felix did, to convey interesting details about their assigned country.

Groups may work at their own pace to complete letters and share accordingly. If others finish earlier, they may go on to individually research a country that was not mentioned in the story. Software, leveled books, maps, and other resources scaffold students as they apply their research skills in a new assignment. Text and drawings depicting the country's characteristics are added to index cards that are placed into envelopes. Separating and labeling data on cards by categories such as climate, economy, government, history, flag, location, and population promotes classification skills. Finished envelopes are displayed on an interactive bulletin board, so that classmates may explore envelopes and read about other countries. For students with writing, spelling, and drawing challenges, additional software such as *Storybook Weaver Deluxe, Start Write, Creative Writer, and Word* may be used so that *all* students can participate. Printed documents can be inserted into the envelopes instead of index cards.

Some students may finish before others. As they do, they are given paper cutouts of rabbits. Students synthesize information from their envelope research projects and use text and drawings to depict their country's characteristics on one side of the rabbit. They use resources to locate and express the same kind of information about their home state on the opposite side of the rabbit. The rabbits are hung with string from the ceiling and provide continuity for the context of Felix, the world traveler.

Allow Time for Student Work to be Self-Paced

Imagine this fifth grade classroom: as students complete their envelopes, others are comparing and contrasting state and country facts on paper rabbits, while others are moving on to the next task at their own pace. Carroll (1963) posits that students learn at varying rates and should be given adequate time to learn new material. He suggests that as students master objectives before others, they go on to participate in enrichment activities. Ample time to "thoroughly explore, understand, and use information and skills" (Kovalik 1997; 1999) leads to comprehensive understanding. Opportunities to repeat skills within the same theme and in subsequent themes extends schema and reinforces learning (Reigeluth 1999; Kovalik 1997; 1999).

Encourage a Learning Community

Next, learners are grouped into pairs. The teacher discusses persuasion and how it is used. The pairs choose a country to research and use the facts to persuade people to visit this country via a travel commercial. Students write a persuasive script, include five to ten details about the country, construct a backdrop and props, and present a travel commercial in front of the class as the teacher video tapes it for later review. This experience provides yet another form of assessment for the teacher and allows students to capitalize on and increase their intelligences as Gardner (1983, 1999) suggests. In this case, the travel commercial engages students in role-playing and collaboration to increase understanding.

All students may not complete a travel commercial. When most students complete most tasks, the class explores and discusses the format of local, national, and international newspapers. The unit's culminating project is the creation of a global newspaper. This project promotes community and collaboration through problem solving, planning, and coordination. Since knowledge is distributed among the students in the classroom community (Hewitt & Scardamalia 1998), knowledge is shared (Scardamalia & Bereiter, 1994) as students rely on each other to build knowledge and complete the task (Bell & Winn, 2000, p.128-9). This project promotes individualized instruction within a community setting. Students, who are most interested in sports, may report on current sporting events from around the world. Students motivated by scientific topics may report on global weather conditions or current innovations in medicine and technology. Students intrigued by numbers and patterns (Gardner 1999) may report on business trends or compute average temperatures around the world. Others may use narratives (Gardner 1999) to express insights into diverse cultures. Creating a class newspaper is a large undertaking and requires all students to contribute to ensure its completion. This implies that participants have a shared interest (Wenger, 1998) and are motivated to work together to make a collective product (Scardmalia & Bereiter, 1994). Software, such as *Creative Writer*, provides a template to create a newspaper where students make choices about the number of columns and the type of font, headlines, borders, and graphics to be used. The Internet serves as another scaffolding tool to help learners acquire current information for their newspaper articles. The final product serves as another assessment piece and can be shared with younger grades or community members.

Extend Learning and Transfer in Subsequent Themes

One measure of learning is the ability to transfer new knowledge to other contexts. Though not proponents of situated learning environments, Anderson, Reder, and Simon (1996) studied the work of others to determine three components related to transfer. Their findings indicate: (1) there are varying degrees of transfer, including negative transfer; (2) representation and degree of practice are major determinants of transfer between tasks, and transfer between different domains varies directly with the number of symbolic components shared between them; and (3) the amount of transfer depends on where attention is drawn during instruction (p. 6-8).

To increase the degree of transfer, subsequent themes may be developed that review and expand on the skills learned in the first unit. Using similar characters and tasks in later units facilitates the transfer of knowledge and provides students a framework to build knowledge upon in new contexts. For example, Felix's travels may lead to further inquiry as he visits the moon in *Felix Explores Planet Earth* (Langen & Droop, 1996) or as he travels back through history in *Felix Travels Back in Time* (Langen & Droop, 1995). Felix may even be introduced to another traveler such as Flat Stanley, who slips through the mail. Flat Stanley is a young boy who fits into envelopes because he was flattened by a bulletin board temporarily in *Flat Stanley* (Brown, 1964; 1992). Units developed around these stories and characters serve to extend prior knowledge in new ways so that students may progress toward increasingly difficult objectives. This kind of connected, threaded curriculum helps learners' brains seek patterns and develop a mental organizer to extract from over and over again (Kovalik 1997; 1999).

Applying Theory: Why This Works

This sample unit exemplifies components of learning models espoused by experts. This unit promotes knowledge construction through hands-on activities, collaboration, problem solving, and active engagement (Abdal-Haqq, 1998). The varied activities address diverse learning styles by appealing to visual, oral, auditory, and tactual senses and employ multiple intelligences (Gardner 1999) by engaging students in collaboration, mathematical computation, hands-on activities, and role-playing. Retention of material is greatly increased as Sousa (2001, p.95) explains the average retention rate 24 hours after lecture is 5%; after reading is 10%; after audiovisual exposure is 20%; is 30% after demonstration; is 50% after discussion; is 75% after practice by doing; and after immediate use of learning is 90%.

Understanding is further increased through the pursuit of broad goals in thematic, integrated contexts where media and technology scaffold learners as they complete individual and group projects. Since students collaborate and share knowledge at different points in the unit, they develop cooperation skills that can be applied later in real life situations. Students simultaneously learn that everyone has an area of expertise and something to contribute. The continual application of skills in different contexts during the unit leads to mastery of both knowledge and skills in a threaded manner that can be revisited in subsequent lessons. Through this holistic approach to instruction, teachers facilitate the development of multifaceted citizens who are better prepared for a global society and its diversity, which is the ultimate goal of education.

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East Meets West Times 2: Impact of Cultural Change at Two Universities on Asian Students

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Abstract

Asian students arriving at American universities are subject to massive cultural change, especially if it is their first time being in the United States. Taking concepts from Change Theory (Rogers, 1983 and Havelock & Zlotolow, 1995) and combining it with those of the Affective Domain (Martin & Briggs, 1986), the authors present a cultural adaptation model that may prove useful in working with Asian students in American Universities.

Introduction

Every day that passes presents massive change to students and instructors at all levels of education. Nowhere are these changes more evident than in the area of instructional technology, especially at the postsecondary level. This scenario is doubly complex when the participants are from countries other than where they were born and raised. Instructors and administrators in universities can take steps to insure a smooth transition from one culture to the next by addressing a multiplicity of levels that impact students and instructors from abroad.

This paper addresses the affective domain, and how concerns related to the initial well being of international participants first has its focus on basic survival skills. We readily acknowledge that subsequent focus will ultimately center on cognitive skills but will reserve most of that discussion for another time and place.

Background

During the 2000 AECT-Denver, a group of Asian students shared their concerns about coming to the United States to study in instructional technology program areas. Using Maslow's Hierarchy as a metaphor, they traced a number of areas of concern, most of which revolved around affective domain issues. These included being accepted by their American peers, working in harmony with teams, knowing what to wear, shopping for ethnic foods, developing an understanding relationship with their instructors, dating, establishing friendships, and more.

Harvard's Dr. Robert Doyle hosted the session and in his summary remarks, indicated that this was one of the most valuable and insightful sessions that he has attended in many years. This paper reviews some of the issues discussed during the Denver conference and connects them more directly to the affective domain and change theory. The work of Bloom (1956), Cotton (1995), Martin and Briggs (1986), Rogers (1983); Havelock & Zlotolow (1995) contain significant implications as to development of viable strategies to ease the transition of international students and instructors into the academic and personal mainstream of the countries in which they choose to study. Multicultural theories cited by a number of other writers connect the dots related to affective and change and thus create a better understanding (Lewis, 2000; Mead, 1998; Morrison, Conaway & Douress, 2000). While these latter authors mainly address multicultural elements related to business, it is our belief that many graduates of instructional technology programs will find themselves facing dilemmas within the context of multinational organizations.

Differing Issues Identified

In the following pages the reader will experience something very remarkable -- articulate concerns expressed by a number of students, few of whom were able to speak English with fluency less than two years ago. They are now not only able to write with considerable precision but, when asked to deliver their material verbally, do so with confidence and enthusiasm. Those same students, twenty-four months previous, would have remained mostly mute.

The reasons for such changes are in part, due to caring faculty members who very quickly identify communication problems with their international students. Rogers (1983, p. 321) describes part of the problem:

> Change agent [professors] empathy with clients [students] is especially difficult when the clients are very different from the changer agent; we expect change agents to be more successful if they can empathize with their client. Although there is very little empirical support for this expectation, we tentatively suggest Generalization 9-4: *Change agent success is positively related to empathy with clients.*

Rogers adds:

> If empathy is important in change agent effectiveness, how can it be increased? One method lies in the selection of change agents; those who have been in the client's role are better able to empathize with it. For example, agricultural agencies often seek to employ change agents who have come from farm backgrounds.

While we do not advocate that all professors who teach international students mirror the ethnicity of their learners, we feel that a faculty member who has prior international experience is more inclined to be empathetic than one who has not. If a professor has several international students in his or her class, there is a strong likelihood that they reflect an educational experience that has been formal, hierarchal, and pedagogically behaviorist. Martin and Briggs (1986, p. x) describe what the contemporary educator emphasizes when they state: "The stronghold of behaviorism has lessened, and cognitive inquiry, cognitive-information processing, and humanistic and developmental ideologies and theories have been revised, modified, or developed to meet new needs." Indeed, what is an international student to think when confronted with a professor who actually encourages their students to think and do for themselves, to manage much of their own learning?

Martin and Briggs (p. x) articulate the potential for future problems among international students of rigid academic backgrounds when they discuss evolving curricular changes in that "…the focus of curricular and instructional content has broadened. Affective aspects of the curriculum are now being incorporated into lessons and units. Attention to attitudes, values, ethics, morals and the self-esteem of learners is demanding time, energy, and effort, alongside the important cognitive dimensions of curricula." Given these changes in pedagogy, how do our international students view such changes? How do they adapt and subsequently for some, adopt the change in how they view both studies and life in an American university?

Indeed, the following short essays written by several Asian students, all of whom brought with them pedagogical rigidity, provides a near-alarming look at how they perceive their professors and how they have adapted to such change. Appended to some of the essays are recommendations; others declined to offer such.

There is some degree of overlapping ideas presented, primarily due to the reality that many of the affective issues they raise are woven into the larger fabric of work and life outside the classroom.

Interaction with Peer Students

By Corey Lee

Extensive research in effective teaching and learning emphasizes the significance of social interaction. According to Vygotsky (1978) social development theory, social interaction is vital to cognitive development; all higher-order functions originate because of interaction among individuals. In light of this, the amount and type of classroom interaction cannot be ignored when examining Chinese students' learning in the United States.

It has been recognized that Chinese students pursuing a higher education in Western countries demonstrate limited interaction in American classrooms (Tu, 2001). Several factors might contribute to Chinese students' inadequate participation.

First, the foundation of Chinese education is grounded in Confucianism, in which values and morals are much different from Western philosophy (Brooks, 1997). While individualism, assertiveness, and sometimes, aggressiveness are often promoted in Western society, silence and temperance are valued in Chinese society. Consequently in communication, Chinese places the "emphasis… on the receiver and listening rather than the sender or speech making" (Yum, 1994, p.83). Therefore, in a classroom environment, Chinese students tend to be more conservative and quiet than are their American counterparts.

Second, the presence of a rigid hierarchical system, valued in Confucianism, leads Chinese students to regard their teacher as an "all-knowing" savant on stage with absolute authority over the subject matter. One's teacher is the sole source of knowledge in Chinese classrooms. With this mentality, discussion and interaction among students are considered trivial and, sometimes, useless.

Third, even when Chinese students are willing to participate in classroom discussions, they fear expressing what may be erroneous opinions to fellow students, which leads to embarrassment or creation of a negative impression. Therefore, Chinese students are often considered a silent group in the American classroom. Despite the instructor's encouragement, they are reluctant to express their feelings or opinions and to participate in classroom discussions (Tu, 2001).

Finally, reduced or no interaction by Chinese students also originates from their limited ability to speak English, which restricts their participation in the classroom. In Taiwan and China, English language education predominately emphasized reading and writing; little attention was paid to listening and speaking. As many Chinese students come to the United States, they lack sufficient communication skills, which hinders their classroom participation. Moreover, the swift change of discussion topics in the classroom poses an even greater problem in this situation (Tu, 2001). As Chinese students struggle to conceptualize the subject just discussed, the focus changes to the next topic.

Having a cultural background rooted in Confucianism and deficiency in English capability, Chinese students exhibit far less interaction and participation in American classrooms. By being sensitive to these difficulties that face Chinese students, the Western teacher can play an active role in facilitating far more productive interactions between and among Chinese and American students.

Some suggested techniques are:

1. Rather than call on a Chinese student in front of the class, form students into small groups and let the group consensus be reported by one among them, ensuring that the person providing the answer is not always Western.
2. Have students write an answer to a question and randomly call on *all* students in the class, including those who are Chinese. Having sufficient time to frame an adequate response will generate more appropriate replies, thus lessen the loss of face feared by the Chinese student.
3. Have the students create a one-slide Power Point response to a question, assigned in advance. Having prepared before class, (and the Chinese students will invariably have done so), reduces anxiety, and allows all students to contribute equally.
4. Involve Chinese students in panel discussions wherein they are members of a team and, as such, will feel increased responsibility to participate.
5. As the Chinese students become more familiar with other members of the class, and with the techniques listed, they eventually should be called upon individually, to reply in class. When a teacher does not call upon the Chinese students or lets them off with low-order responses, no one is served.

Cultural and pedagogical assimilation for Chinese students can be extremely uncomfortable, especially during the beginning semesters in a Western university environment. The sensitive teacher will accommodate this discomfort by gradually moving their Chinese students into the mainstream of classroom activities. By showing concern for such students from the beginning, the good teacher can make the educational experiences of their Chinese students productive, fulfilling, and yes, even enjoyable.

On Chinese Self-Discipline

By Cheng-Chang Pan

When it comes to self-discipline and its role and impact on multicultural learning environments, Chinese students tend to acquire and value self-discipline. According to Ritts (2000), self-discipline as well as other qualities are passed on to new generations by "training" or Chao-shun, acquired from parents, and rooted in Confucianism.

Confucius' teachings have been conveyed to his descendants culturally and individually, and have had a major impact on the ethnic group. Confucius was temperate and self-disciplined, and he was a man of wisdom and good manners (Beck, 2001).

A perspective of social learning theory holds that individuals learn by interacting and observing others as to how new behaviors are performed. Kearsley (2001) supports this concept when he states that "...individuals are more likely to adopt a modeled behavior if it results in outcomes they value."

Chinese students, given their heritage, are inclined to place authority figures in high esteem. Teachers, for instance, are highly valued by students, which may not be the same elsewhere.

Given the author's experiences in Taiwan, teachers are also highly valued in society. Teaching positions are gaining in popularity as the economy shrinks and slows. Affectively speaking, students honor themselves when listening to the authority's lectures, so they model the authority and follow the authority's teaching. Therefore, they pride themselves in being a follower of the master.

Individually, Chinese students are apt to accomplish tasks designated by the authority to demonstrate their capabilities and thus reflect their potential. They seldom ask questions in class, in part because they feel ashamed to do so. Those individuals are ones who wish they had been better prepared before coming to class.

When Chinese students come to the Western world, they encounter a great cultural impact. While accommodating themselves to the foreign country, they are assimilating themselves into this melting pot, in hopes they will adjust to the new environment sooner and stand out among their fellow classmates. ***If they take a hybrid stand and merge self-discipline from the East with assertiveness from the West, Chinese students will have a promising future in the foreign environment.***

Professor-Student Interaction
By Zhengzi Wang

As an Asian student intending to study in the United States, a main concern was how to establish contact with professors in the department. It is well known that professors are key sources of information about assistantships, or even scholarships. E-mail became this author's best method for communication with the professors. First, it was possible to proofread letters to professors and others at the chosen university many times. Secondly, it was fast and there was no need to make an appointment with the professor. Other Asian students had the same experience. Many Asian students begin to communicate with their professors long before they get admitted to the universities in the U.S. The author corresponded over 100 times with her professor before coming to the United States.

The professor is generally the first and the only person that an international student can comfortably contact. Students will probably throw a wide range of questions at their future professors, from admission procedures, to cultural issues, to advice about the apartment rentals. In this case, a professor, who is already busy in daily life, must meet the challenge of efficiently dealing with these inquires. Students should reserve their difficult questions— i.e., how can I get an assistantship? — for professors, while answering simpler questions using the variety of resources available, such as the Internet, friends, books, their chosen university's website, etc.

China's cultural system is based not on the strength of the individual, but on the pattern of relationships maintained by all people. In communication, the Chinese put emphasis on the receiver of messages and on listening rather than on the sender (Brooks, 1997). As Bond & Hwang (1986) have pointed out, "the western starting point of the anomic individual is alien to Chinese considerations of man's social behavior, which see man as a relational being, socially situated and defined within an interactive context."

Due to the utterly different cultural factors, a lot of Asian students experience difficulty when adjusting themselves to the American classroom culture. Silence is not golden anymore. American peers are eloquent, talkative, and humorous in class. Sometimes, we feel much pressure competing with them for the professor's attention. A lot of negative self-talk generally results," I don't understand my professor's words, what shall I do?" " I don't agree with the professor, so should I confront him right away?" "I want to go to the restroom, but can I leave when the professor is talking?" "Oh, she speaks so fast! I couldn't even understand a word!" So, many Asian students, like the author, don't participate in class at the beginning, even if they can speak English well. Consequently, some concerns arise. "What will the professor think about me? Dumb? Slow-learner?" "Does he know I am smart enough to understand what he said, but just didn't speak out?"

There is solid social background behind this thinking. Confucian philosophy permeates the whole of Chinese society. Confucius believed that a hierarchical system was essential to the harmonious well being of society. This, in turn, is reflected in the Chinese classroom. Students regard their teacher as all knowing, and the absolute authority on the subject matter. Due to the rigid teacher-student relationship, Chinese teachers are under severe pressure not to make mistakes, not to misguide students, and not to be criticized. Such behavior on their part allows the teacher to maintain their "all-knowing" and "ever-correct" status. It is the duty of students to give the utmost respect to their teacher. Thus, to ask questions of the teacher is tantamount to questioning the position of the teacher, and therefore is not a feature of Chinese classrooms. Rigid order and formality are the main features of the Chinese learning environment. Chinese teachers and students know that the classroom is a place where serious knowledge is taught.

The major concern of Asian students is that their American professors think less of them because they don't speak a lot. Professors need to be aware that classroom participation does not always mean "shouting and yelling and hands up". A lot of times, Asian students participate in class in a different way. They do more critical thinking in their minds. Sometimes, it's better to give the floor to Asian students rather than waiting for a general response. On the other hand, students shouldn't get too self-conscious about themselves speaking English with an accent. They should practice English more to overcome the initial fear of speaking English in public.

A rewarding college experience is typically viewed as students in a classroom busily engaged in the pursuit of learning with their professors. Missing from this picture are faculty and students interacting outside of the classroom environment. Yet this less common image is equally important to a successful college experience (Maestas, 2000).

In the author's college days back in China, we seldom had social contacts with the professors. Mostly, we met our professors in class, discussing serious academic issues. Teachers are considered as an authority figure, and it was hard to look at them as a person.

In the United States Chinese students can access their professors through e-mail 24 hours a day, 7 days a week, discussing academic issues. Also, some professors like to entertain international students in their homes, to celebrate special occasions. This is a good time and place to talk to the professors, letting him/her know you as a person. In our program, all the international students are regularly invited as guests to our professors' house to celebrate Thanksgiving, Christmas, Chinese New Year, Autumn Festival, etc.

Asian students should establish an academic contact as well as a social contact with the professors. In this way, they can get more attention and demand more interest from professors about their studies.

The fact that all the international students pay far more tuition more than local residents is a reality. Consequently, rightly or wrongly, we expect quality education as well as cultural enrichment. Lack of communication and a restrictive cultural notion of propriety seem to be the major obstacles to professor-student interactions, as each attempts to find ways to balance tradition and modernization. It takes time for both sides to realize the gap and to improve mutual understanding.

The Purpose of Seeking a Graduate Degree in America

By Alan Ku

Every year hundreds of thousands of Chinese students come to America for advanced studies. Why do they choose to fly thousands of miles from home, leaving their families and friends behind to go to an unfamiliar country where language, culture, life style, and language are so different? This essay has a focus on their objectives in engaging in study abroad and examines different motivations between those students studying abroad and their American counterparts.

First, American and Chinese students place different utilitarian value to a graduate diploma. To American students, obtaining a graduate degree means they have more professional knowledge and skills in their field, therefore they have a better opportunity to upgrade their existing position and earn a higher salary. But to Chinese students, a graduate degree, especially from the United States, not only increases the likelihood of employment; but also promotes social status. This is because, in Chinese society, the diploma he or she holds largely determines a person's dignity and value. Therefore, although obtaining a Masters degree takes much time and money, they still choose this path.

The second factor that drives Chinese students is pressure from the family. In the traditional Chinese culture, children receive continuing support from their family throughout their schooling. Chinese parents consider it is their responsibility to do so. In addition, Chinese parents encourage their children to pursue higher degrees and sometimes even make that decision for their children. Most Chinese students follow their parents' wishes when attending graduate school. This is both a natural and inseparable condition in Chinese society.

On the contrary, American students do not expect their parents to pay for their tuition for higher education. American parents, unlike their Chinese counterparts, do not expect their children to look after them in the sunset of their life. The result is that most American students make their own decisions when choosing their major and are not in a hurry to obtain a graduate degree!

The Classroom Environment

By Terry Tao

According to MacAulay (1990), "A classroom environment consists of the intellectual, social, and physical conditions within or exogenous to a classroom that influence the learning situation."

It is not difficult to identify a variety of physical factors that affect how students feel about their classroom environment. Following is a sampling of available information that supports the need to consider many aspects of the classroom climate in order to create an environment for maximum learning.

Environments that are psychologically or emotionally negative inhibit learning (Midjaas, 1984). Studies have found direct correlations between students' cognitive styles and responsiveness to environmental characteristics. In responsive classroom environments, students' achievement increased (Dunn and Dunn 1992). Many classrooms in American universities are better equipped than in other countries. Normally in every American university's classroom, there are projectors, computers, and a central air conditioning system.

Fewer students in a larger instructional space enhance the use of available resources. Spaces where high density and few resources exist add to increased student/teacher conflict and poor student-to-student behavior (Midjaas, 1984). When comparing the population density, United States' class sizes are much smaller than in Asian countries. All these advanced physical classroom environments enrich the quality for studying by international students in the United States.

The amount and quality of classroom light is conducive to 1) greater comfort and contentment; 2) a more cheerful environment; 3) more concentration and a greater desire to work; 4) less fatigue and therefore fewer related side-effects, such as laziness, bad posture, nervousness, and lack of interest; and 5) greater accuracy and neatness (Hathaway, 1983). Use of blues and greens fosters feelings of relaxation. Use of red and orange colors in instructional areas induces anxiety behaviors (Weinstein, 1981). Color affects changes in mood, emotional states, psychomotor performance, muscular activity, rate of breathing, pulse rate, and blood pressure (Hathaway, 1983).

When referring to a cheerful, cozy and comfortable classroom design, there are two minor differences between United States university classrooms and Asian university classrooms.

In American universities, many classrooms have no windows. This amazes me Chinese students when first entering the classroom. There are two primary reasons for this difference: projected visuals will be viewed better without windows and the scene outside of the window will not distract students. Actually, there is no clear-cut relationship between the noises associated with school and student performance on task (Arends, 1994). In Asia, it is very typical construction design to put some windows in the classroom, and plant some trees outside of the window to block the students' view. In most Asians minds, the best place for studying (sometime they call it training) is a place with nice natural environment and fresh cool air. The film "Crouching Tiger Hidden Dragon", depicted a good Asian sense as to the ideal training environment.

Another difference is the design of both seats and desks. In American universities, many classrooms do not have desks for students. Frequently there is only a piece of board combined with the chair. However, in Asian Universities, every classroom has desks for students. Asian students received extensive training on how to write when they are growing up. For example, when Chinese children are doing their homework, they are required to sit up straight and put two hands on the paper. In order to adjust the children's study habits and develop good attitudes, correcting their sitting and writing style is a good way in the Asian parents and teachers minds to maintain a positive study attitude. Gradually the connection between desks and writing is solidified. Therefore, some professors will feel curious that many Asian students seldom take notes during the class, when there are no real desks available.

Personally, this author feels that the physical side of the classroom environment is not as big a problem for international students as compared to the "soft" side of the classroom environment.

What is the intellectual and social environment within the classroom? What takes place during the time before the class begins, during the class break, and after class? We can call it social time. Normally in every country, students will cherish it and make friends with their classmates. They will naturally divided into several little groups and chat with each other.

Rogers (p. 71) felt that ..."interpersonal networks among peers energizes the [diffusion} process. He goes on to state that one of the important roles of [diffusion] leaders (professors?) was to interconnect the spatially related cliques of the village" and that" a general conclusion from who-to-whom studies is that space and social distance are the main determinants of who talks to whom in diffusion networks [classes]." Herein lies a sensitivity point for professors to ponder.

For international students, these social times are frequently the most uncomfortable. There are several reasons that lead to them felt embarrassed or uncomfortable. First, the language barrier is the main reason. For international students, English is their second language. There are so many different accents, slang, and terms. Second, unfamiliar topics are another reason. Most of the time, international students feel they have nothing in common to talk about related to these topics. Therefore, it is not strange that most international students just remain quiet.

This kind of classroom environment will definitely influence the learning of international students. As international students, we need do lots of work from our side. We cannot complain that it is "discrimination". Learning the culture and communication skills is as important as learning academic content. Of course, some times we also need the professors' help to open up some possibilities for students to know each other. It is also very important to establish collaborative learning. Different professors some times really can make a big difference. This author took some courses in which he made several very good friends; and he also took some courses in which he did not know any of his classmate's names.

There are several other things about classroom environment. For example, an instructor's personality often determines the type of classroom environment. Tonelson (1981) had no doubt about the interconnectedness of teacher personality and the learning atmosphere in a classroom. He suggested a mechanism whereby the teacher's personality can affect student-learning outcomes through the psychological environment of the classroom. He believed that this environment was essentially the product of the kinds of interactions teachers have with students. He argued that the character of the teacher is translated into the working social atmosphere of the classroom, which in turn, influences students. That type of atmosphere sets the stage for learning. For international students, an instructor's personality can significantly interfere with their learning. A good instructor must demonstrate a repertoire of appropriate interpersonal and pedagogical skills. In the classroom, students learn knowledge, adapt to the instructor's personality, absorb the culture, and master communication skills simultaneously.

Conclusions

Martin and Briggs (p. 449), in summarizing their seminal work, include the statement that, "we believe that the cognitive evaluations that individuals attach to feelings, the category emotions, underlie the individual's development of attitudes, interests, social competence, and other related affective categories. Feelings, we propose, are generally attached to emotions, at least as the way we have defined them." It is this development within our international students that each of us is charged to cultivate. The essays we include in this article address each of these concerns and more.

The process of interweaving multicultural elements with change and affect theories, while complex in its execution, will hopefully give insight as to the nature of innumerable problems faced by students and instructors when they go abroad for study and teaching. What we have indicated as being problems faced by Asian students are, in reality, those faced *by all students*, no matter from where they may have come.

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Ethical Breaches With Educational Technology

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Introduction

Like most aspects of life, educational technology is multi-dimensional in its relations to people and the environment; educational technology can be good and bad and everything in-between. This group of experienced educational technologists has taken a balanced, honest, and sobering look at people's (including our) uses of technologies for education, and we realize somewhat uncomfortably that often some of our connections to educational technology have questionable consequences for ourselves and/or the people we intend to help. Our connections are ethically questionable. As representatives of the AECT Ethics committee, we have chosen to present (and publish) a discussion regarding these occasions when we have found ourselves involved in ethically challenging situations. Each author's primary aim is to relate an instance when he or she was associated with an ethically questionable or hurtful use of educational technology and, then, to encouraged discussion among others regarding that instance or a similar one from their own experience.

Further, each presenter will discuss her or his instance in terms of ethical principles and how the principles should guide educational technologists' work. The ethical principles come primarily from AECT's and AERA's (American Educational Research Association) professional codes of ethics. The idea of iatrogenics (where that which people create to overcome a "problem" makes the problem worse) and the paradox of human consciousness (it hurts as much as it helps) also are used to explain our ethically questionable uses of educational technology.

In terms of the primary aim of this paper, the first author tells the story of the ethical dilemmas encountered as an instructor in intellectual property, when she finds herself dealing with students who violate copyright law in her classes. The next author tells of instances in one school district where she has seen too little being done to offset the fact that technology is promoted without enough thought and conversation among all concerned parties. The final author describes the dilemmas he faces as an educational technology teacher-educator between encouraging pre-service to learn technology skills and technology integration and the technical, pedagogical, and curricular realities that the teachers will face once they are in classroom.

The formal part of our AECT presentation ended with these questions:

- Once you discover that you or someone else is doing harm with educational technology, what should you do?
- If you continue with the status quo, do ethical breaches move from the realm of ethical mistakes that might be forgiven to intentional behavior that requires punishment of some sort?

In our AECT session we each spoke briefly about the examples that follow. We then opened the presentation for discussion, which was lively. Each author remarks on the discussion in the section following his or her example.

First Example: The Ethical Dilemma Created by Copyright Violations in the College Classroom

My ethical dilemma stems from the muddy world of copyright law. As a faculty member who teaches classes in intellectual property, I am very aware of the many instances of copyright violation that can occur in a college or university setting – especially those among students in my own college classrooms. This comes to a head during assignments, oral and written presentations, many times when I ask for informational materials or media to support a particular belief, argument, or point of view. Invariably, one or two students feel that the best way to support their argument(s) is to take large amounts of factual material directly from one or more sources, copy it, and give each class member a copy. This is often in violation of the Fair Use principles of copyright law and/or without obtaining permission from the owner or creator of the work from which they are borrowing or copying. In most instances, other than if they are taking or have taken my intellectual property classes, these students have no concept that they are violating copyright law. Additionally, because copyright law is so complex, the other classes I teach do not usually have any aspect of copyright law as part of the curriculum.

Thus, when as an instructor I am suddenly confronted with these violations, I am not sure what I should do. Certainly, this might be a "teachable moment," whereby I go into the whole of copyright and what that particular law means to us as students and educators. However, in most instances, I am not happy with the time that this will take away from the subject of the class in progress. In addition, I also am reluctant to embarrass the student(s) who may be in the process of violating the law as they hand out whole articles, book chapters, etc., sans the permission needed to copy these legally for class. Thus, I find myself in the unique position of realizing that there might be an infringement in progress, but not wanting to put the student on the spot by questioning him/her in the midst of his/her presentation. Also in many instances, such a subject "leap" could redefine the whole atmosphere of the class in progress. Thus, my ethical dilemma is: how much "policing" should a faculty member do in a situation that appears to be within the realm of copyright violation, and yet probably will not go outside the classroom? What about the time needed to change the foci of classes? Should I pursue a subject area that will change the focus of a class, especially if it interrupts student presentations?

Solution?

Given the current foci on intellectual property issues in technology, especially the electronic environment, perhaps the answer to my dilemma lies within my syllabus. By placing a copyright statement in the syllabi of each class, and going over the syllabus at the first class meeting, a short discussion on copyright and violations will automatically be covered. Thus at later dates, should a copyright violation occur, it may be possible to make a statement at the end of the class about how we as students and educators need to observe and follow intellectual property laws. In this way, student presentations and discussion would not be interrupted and a short teachable moment could still occur. What do you think about this dilemma?

Second Example: Consulting with a School District

My ethical dilemma involves the role many of us play in our communities: educational technology consultant to the school district. I have often been asked to provide consultation, training or staff development, serve on technology committees, and so on, in the communities around our university. What this has often meant has not been a "pure" consultation opportunity; it has been, instead, an invitation to help promote or encourage the use of technology in the district, and to help teachers use more technology in their classrooms.

Why is this a dilemma? Isn't helping to promote educational technology a big part of our role? The problem comes for me because I am often not asked to offer suggestions on how best to integrate technology, or which technology to purchase and use. My expertise is requested after the moneys have been spent and the equipment is in the buildings, and teachers are "resisting" using it enough to suit the administration who offered its purchase. I know I am being asked to help promote technology use, to provide staff development on the best ideas for technology integration, and to support the purchase and use of technology already in place. I am not, really, being asked to consult on purchases, or question expenditures, or facilitate discussions with teachers about whether or not they should use technology in their classrooms. That much is clear from the requests I receive. And whether or not these are consultancies for which I am being paid (they usually are not), I feel some responsibility to "give the client what he wants", to provide the service requested.

The dilemma comes from my reluctance to continually promote technology without questioning its appropriate use and the problems that can occur. School district administration professionals are not asking me to help them explore the inappropriateness of a technology purchase, nor are they expecting me to help teachers examine the problems they will probably encounter in attempting to integrate technology. These administrators want to hear the joys and positive effects, not the problems or tribulations of innovation or the possible negative effects on the learning environment of adding too much technology without being prepared. What should I do? How can I take this opportunity to help teachers and administrators, and still have my voice heard, and included the next time? How far should a consultant go in suggesting the reasons that the requested work is answering the wrong questions, or that the solution already identified may create more problems than it solves?

Solution?

The audience at our presentation enthusiastically identified with this problem. Many of them encouraged a similar solution: be prepared to offer your expertise, both sides of the issues, regardless of the original request. Some pointed out that it was impractical not to, since the consultant could be blamed later if an innovation did not work out. "You told us that if we did it this way, learning would improve", that sort of attack could follow. However, the case example also reminded members of the presentation audience that we have an awesome responsibility as well as the technology skills. We are ethically bound to help people examine their choices and to question the efficacy of the solutions being posed. If we try to "please" by merely teaching teachers, or supporting technology professionals, we are only doing half our jobs. The discussion encouraged us all to consider the long-range use of technology, the problems teachers and students face with technology integration, and to be honest and open about our doubts or reluctance when we are being asked to consult with schools.

Third Example: Technology Training and Teacher Education

My dilemma arises from my role as a teacher-educator of educational technology responsible for teaching the only required technology course at my institution. In this five week summer course I introduce students to a myriad of technical and pedagogical skills including web development, constructing computer-based presentations, creating spreadsheets, evaluating educational software and web sites, using electronic communications like discussion boards, learning Fair Use guidelines and creating technology-infused lesson plans. The course involves a tremendous amount of content and skills building in a short time. In the context of taking this course students are taking a full schedule of other courses as they begin their year-long teacher education program. In short, my students are quite overwhelmed.

I find myself in an ethical conflict as I consider how much information that I should provide my students about the realities of what they may face in the schools in which they will teach. These realities could include:

- computers that are unreliable, out-of -date and that frequently crash
- Internet connections that are slow or inconsistent
- filtering software that blocks sites that they wish their students to visit
- computers that don't have the software that teachers wish to use or are locked down so that teachers can't add their own legally purchased software without going through a long, often unsuccessful bureaucratic process
- curricula that is driven by standardized tests and that leave little room for creative uses of technology
- lack of professional-development opportunities related to technology

These are just a few of the roadblocks to using technology that teacher's may face. In addition to reflecting on how much of this information to provide students, there is also a body of literature about educational technology that is critical of the uses of computers in the classroom. This literature addresses a variety of topics including how technology takes resources away from other aspects of schooling including the upkeep of buildings, how a heavy reliance on technology in education can detract from other ways of knowing and learning, and as the previous example notes how it is not always appropriate to use technology because of various developmental and pedagogical reasons.

What I have encountered in grappling with this dilemma over the years is that delivering too much of the "bad news" and critiques discourages students who are overwhelmed and need to be motivated as they make their way through the course content. Part of how I address this is by informing students of these challenges in a situated manner throughout the course.

In addition to this example, during my presentation I mentioned a similar dilemma that I have in my role as a technology integration trainer for faculty in my college. Because of tremendous administrative and accreditation pressures faculty are being compelled to demonstrate how they integrate technology into their teaching. As a trainer I must always measure how much information that I provide faculty about the amount of technical information that they must learn to implement their ideas. I want to be realistic without being discouraging.

Solution?

In discussing this issue with audience, the consensuses emerged that one is obligated to present students and faculty with the full picture. Audience members observed that by providing all the information about educational technologies that students and faculty can make fully informed choices about whether and how to integrate technology. In general, I agreed with these observations, however this solution did not address for me the issue of motivation in the face of ISTE (International Society for Technology in Education) standards and NCATE (National Council for Accreditation of Teacher Education) accreditation. Technology integration in some institutions is no longer a choice for teachers and faculty, but a requirement for tenure and promotion. The dilemma still remains for me of how to maintain a realistic and critical representation of educational technologies in the face of institutional and societal pressures that discourage us from taking steps away from the forward momentum of technological innovation and diffusion.

Conclusions

Professionals in educational technology, professors of our field, future teachers, and students entering our field, all need to continue to discuss and debate the ethical dilemmas in which we find ourselves. The AECT Ethics Committee encourages all of us to read, understand, consider, and debate the Ethics Statement and to help explore the ethical choices we all make. The AECT website (http://www.aect.org) can provide further information on our Ethics and the *TechTrends* column on ethics and other AECT publications can provide further examples of cases for discussion by all of us, especially those of us who are teaching future professional in our field.

Systems Planning for Faculty Development: Integrating Instruction with Technology

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A process for implementing a faculty development program is described. The goals are integrating instruction with technology and professional development. The model is based on systems planning and draws together learning factors and implementation strategies. Outcomes include understanding the feasibility and critical concerns of this initiative.

The key word in this discussion is "planning." The field of instructional technology is rich with models and systems for planning or designing that are particularly useful for planning a program for faculty development because the intent of such a program is to be instructional. The organization of this discussion includes five parts: 1) Developing a Vision; 2) Looking at Successful Practice; 3) Implementing the Vision; 4) Realities; and 5) The Future. Pertinent considerations are discussed and relevant models are referenced to help guide the planning for a faculty development program.

Part 1: Developing a Vision

Imagine your vision of the institution in a few years. See yourself being there. See how faculty development is done. Have a vision. Appreciate the substantive nature of the change in the organization from the current. See real changes that result from effort (Marcinkiewicz, 2001).

Because the implementation of a successful faculty development program requires a change in the organization of an institution, it can be daunting. Knowing that you can accomplish this is the most gratifying part. And, it is a good idea. Perform a short test on yourself, "What would be the consequences if you did not proceed?" See if you would be satisfied with the consequences.

Goals

There are two goals of this discussion, your appreciation for and understanding of processes that will lead to the institutionalization of faculty development, and the integration of technology with instruction.

Short History of Faculty Development

Faculty Development programs in higher education are a recent phenomenon. One of the earliest was formed about twenty years ago at the University of Michigan. But there is a reason that development offices have not been commonplace; simply, the absence of development is a reflection of the expectations of higher education on the professorate. Most often professors have been hired because of their expertise in a subject area or because of their researcher. The contradiction is obvious, professors were expected to know something, teaching was either simple enough for an intelligent person to figure out or it was less important than subject expertise or research.

A change in thinking in higher education about teaching, the roles of professors, their preparation for teaching, and their continuing learning about teaching is reflected in the establishment of faculty development programs. One of the motivations for faculty development may very well have been the changed role of students. Students are expressing their expectations of professors one of which is for the professor to be an effective teacher.

There are a variety of names for faculty development programs. They are usually organized as centers and their titles often include one or more (sometimes all) of these terms: faculty, development, teaching, learning, and excellence. In summary, we have come to expect teaching from teachers and we are providing the means for faculty members to learn about teaching until they are done learning, which is to say that they will learn continuously.

Part 2: Looking at Successful Practice

The first planning tool discussed is a gap analysis that identified the areas to be addressed at my former institution, Ferris State University in Michigan. The program there was the Center for Teaching, Learning, & Faculty Development (CTL&FD). The discussion of the CTL & FD is organized by the structures of a gap analysis: the optimal state, the current state, followed by the response and the outcomes.

Optimal State—Wanted...

The optimal state included several areas. First, there was a desire for widespread interaction among faculty on a decentralized campus. Second, there was a felt need for increased communication. Third, there was a desire for reflection about teaching. Fourth, there was a need for training for faculty. And, finally there was a need for professional development.

In general, we wanted to communicate and to learn. The gaps reflected the view taken by Peter Senge in the "Fifth Discipline," that the goal of communication is learning. We wanted to learn and our communication channels were not functioning well.

Current State—Had...

The current state comprised several areas throughout the university.

The faculty were frustrated with the absence of a means for them to improve or even to establish skills in teaching. Many faculty members were directly hired from business and industry and so unlike their colleagues who were hired from other academic institutions, they were not even familiar with the setting. Both sets of colleagues did share a lack of preparation for teaching.

There was a sense of fragmentation at the university that was evidenced by activities that were occurring at one college that had relevance for the entire institution but were not known by members outside of the college.

There had been proposal for a faculty development program which was a reflection of pent-up demand for learning. These are the artifacts of a functioning system that was not acting cohesively.

Response—Did…Structure...

The Office of the Vice-President for Academic Affairs approved the establishment of the CTL & FD. These are some of the structural elements that were introduced.

Varied schedules of activities

Commonly available times ("holy hours"). Thursdays from 11 AM to 1 PM had been a part of the existing schedule reserved for university-wide activities such as faculty development. The CTL & FD encouraged adherence to the schedule.

Training sessions were scheduled for short and long periods. Some sessions lasted three to five days. We favored very short sessions lasting fifty minutes that focused on a single concept and which were repeated several times. The aim in scheduling was to offer as many opportunities for attendance as possible, in other words, to be accommodating to the widely varying schedules of faculty members.

Special interest groups

We actively made the acquaintance of faculty members sometimes directly visiting offices to introduce ourselves in an effort to build awareness for the activities of the CTL & FD and to learn about the interests of faculty members. These activities led to the formation of special interest groups that were supported by the CTL & FD with coordination of meeting times and places and the provision of refreshments. Some groups that formed included interests such as public speaking, web development, grant writing, and scholarly writing.

Individual consultations

The interactions between the CTL & FD staff and the faculty were not only in workshops or group meetings, we also scheduled individual consultations with professors as well as meetings with entire departments.

Faculty as facilitators

There was variety among our presenters as well. The richest pool was from the faculty itself. In fact, faculty appreciated very much the opportunity to learn from each other.

Response—Did...Philosophy

We listened carefully and often to faculty members and our practices were true to learner-centered philosophy in an iteration referred to as "Progressive Education." We ensure that the teaching is tailored to the needs of the learner and we provide opportunities for the faculty-learner to practice during the instruction. The philosophy of our practice is faculty-as-learner-centered development.

The CTL & FD enjoyed an independent status and was not affiliated with any of the colleges, but rather reported directly to the office of the vice-president for academic affairs. As with any effective instruction, we tried to follow up on any activities that we offered. For example, if a person participated in a workshop on syllabus preparation, he or she was asked to be available to advise colleagues. Or, sometimes we would simply send an e-mail message asking whether the workshop helped or continued communication with the individual.

Response—Did…Incentives...

The well-established rule about incentives is that they must be the appreciated by the receiver in order to be valued and motivating. With faculty members, money was not the primary incentive. We tried a variety of financial incentive plans, and large amounts of money did not seem more desirable than a nominal sum that would be considered a professional honorarium. When asked, faculty members first sought the learning; any tokens of recognition were appreciated if they expressed a value for the faculty as professionals. One requisite that was universally effective was the provision of food. Another incentive for faculty especially at institutions that are decentralized is the opportunity to meet their colleagues which helps to build esprit de corps. Perhaps the primary incentive for faculty to continue learning is their innate love of learning. Faculty members are, after all, educators. A final practical point is that participation in development activities counted towards promotion and tenure and post-tenure review consideration.

Response—Did...Activities…

The CTL & FD organized its activities in three main areas mirroring those conducted by Centers around the country as suggested by the Professional and Organizational Development network.

Professional development

This category of activities focuses on the career of a professor such as mentoring, grant writing, scholarly writing, promotion and tenure.

Instructional development

This category of activities focuses on teaching and learning including instruction, assessment, learner characteristics, and instructional media.

Support of the institution

This category of activities focuses on the professor participating in and understanding the system of the institution, including its mission, history, town and gown relationships, the community, and the personnel makeup of the institution.

Achieved...

The faculty and the CTL & FD together achieved very active participation and growth in programming.

- 70% participation rate
  There were over 450 full-time tenure track faculty members who were organized in a collective bargaining unit for which there was no mandate to participate in faculty development activities. Reporting of statistics like these were facilitated by the database created for recording our activities. It served us well when we reported to three accreditation agencies.
- 11% in 15-week courses
  One example of participation was the over-capacity sign up for 10 and 15 week CTL & FD led courses.

- 97%-ile of worldwide users of WebCT
  The demand for a web presence was explosive and faculty driven. Once a course management system was introduced, faculty members sought training and were productive in delegating some of their instruction to the system.
- Hesburgh certificate of excellence
  The CTL & FD was awarded TIAA-CREF's award for a program aimed at developing undergraduate faculty to improve student learning.
- Distributing our services
  The CTL & FD began to train faculty at area institutions.
- Exemplars for other institutions
  We communicated with several institutions to advise about setting up programs.
- 80-90% faculty satisfaction rating
  The CTL & FD enjoyed high approval ratings on university-wide surveys.
- Goal of continuing learning
  The strong support by the faculty was an indicator of progress toward the goal of continuing learning.
- Yearlong transition program for new faculty
  An accomplishment was the initiation of a highly successful program for new faculty.
- No indifference
  It was very gratifying that the mood on campus lacked indifference. There was strong and expressed interest among the faculty.

Part 3: Implementing the Vision

The discussion about establishing a program at your institution is organized by the structures of a gap analysis similar to Part 2, the optimal and current states, but implementation steps are described at length. The conditions are all assumed but considered to be very likely.

Optimal State—Wants...

Because of the universal interest in these two areas among institutions of higher education, it can be assumed that your institution would also be want to operate a faculty program for professional development and instructional development.

Current State—Has...

The appraisal of the actual state at your institution reveals that the following conditions exist. There is motivation, limited funding, and an estimated retirement of 50% of your faculty within the next 10 years. These are fairly safe assumptions and reflect the reality of most institutions of higher education.

Implementation—Can Do...

Use instructional system design strategy to organize your planning especially because your focus will include instruction. There are a variety of models available and in general it is probably less important which model you use than that you do use a model to keep track of your thinking. These well known planning activities organize this discussion about implementation: assess, design, develop, implement, and evaluate. Bear in mind that while, they are presented in sequential order, untoward conditions may affect the order in which you may actually be able to conduct planning. Try, however, to establish your evaluation methods and techniques to be congruent with the objectives you establish.

It is assumed that you would have conducted a process to determine your needs and that was described in the previous section detailing the results of a gap analysis. The next processes in which you would engage are design and evaluation.

Design Steps...Objectives

The following is an example of suitable objectives for a faculty development program.

- Learn about your field
- Learn about teaching & learning
- Serve the institution
- Reflect upon teaching
- Understand students
- Engage in scholarship

The following is an example of suitable objectives for a development program that also serves staff and administration. Recall that traditionally higher education administrators come from faculty ranks and do not have formal training in management or leadership.

- Learn about the field
- Learn communication technology
- Serve the institution

It is important to focus on the ultimate objective of any faculty development program, that is, the development of students. Example objectives for students include…

- Improved learning
- Retention

It is also important possible and desirable to identify objectives for the institution. Example objectives include…

- Competitiveness
- Retention of faculty & students
- High Esteem
- Esprit de Corps

Design Steps…Evaluation

Some purposes of evaluation are to gauge whether your program is meeting its objectives and what factors or conditions are contributing to its operation. To facilitate your assessment and evaluation processes, it is recommended that you establish a database that includes your activities as well as the various units of your institution and the members of the faculty. Gather data counts of participants but also count repeat participants. For example, there may be two activities with 10 participants, but they may be the same 10 individuals. It is desirable to know whether the participants are the same or not. Consider various quantitative and qualitative measures.

As part of your evaluation process, count your failed activities as well as your successful ones. Make plans for what you will do as your activities succeed or fail to meet your objectives.

A valuable practice to introduce for your faculty is the Small Group Instructional Diagnosis (SGID) procedure (Clark & Redmond, 1982). This simple procedure is conducted early in the semester in the absence of the professor. It is a kind of focus group activity intended to get early and candid feedback from the students. It can be effective and is inexpensive. We assess using the SGID format after each of our activities, then annually we do a more detailed survey. Assessment is a burden and intrusion and so we limit our use of them. Try to use varied other formats to gather information. Use phone calls or face-to-face conversations to get input from faculty. Note how often and for what reason a faculty calls the senior administration; it must be pretty urgent for a call to be made to senior administration

Design Steps…Planning Considerations

As part of the design process it is recommended to consider four factors affecting learning. These were suggested by Jenkins (1979) and Bransford (1979): media, assessment, the learners' characteristics, and instruction.

Media

These are pertinent questions to consider.

- What media will you use?

- Who or what will deliver instruction?
- What media are available to you?
- What do you currently use?
- What can you not use?
- What is your institution's plan for providing equipment to faculty, for classrooms, for web-enhanced instruction, for complete online instruction?

Learners' Characteristics

You need to consider you're the faculty and staff administrators and their needs as a group, as subgroups, and as individuals. Some guiding questions are…

What are their particular needs?

- Who are faculty?
- How are people in the academy unique?
- Are there characteristics particular to members of the institution?
- Are they similar to academics in CA (diverse) or NV (from many areas and newly arrived)?
- Who are managers and administrators?
- To what kind of information do they respond?
- Emphasize practical over theoretical pedagogy.
- People outside of a field tend to lack the interest and the preparation to participate in a theoretical discussion at length.
- Low ceilings in faculty career
- Build steps into the career path. Consider starting a senior learning community. See the work of Milton Cox at Miami University, Ohio.
- Administrators often untrained in mgmt.

Characteristics of Faculty Members and Other Academics

- Highly intelligent
- Love of learning
- Strong sense of collegiality

Ask…

- How would you characterize academics as compared to airline personnel, or the military?
- What are their career expectations?
- Why would they want to learn more?

Instruction

Methods of instruction need to be considered. After all, the learners must do something in order to learn. What will they do? How will you orchestrate the activity so that it is effective? These are guiding questions…

- In what activities will they engage?
- What scheduling tactics? Formats? Instructors?
- What methods?
- How will you pace the activities.

Instruction—Best Practices

Some practices that worked well at the CTL & FD included the following…

- Learning communities. Focus on activities that demand communication and collegiality. Remember the strong sense of collegiality among academics.
- Learner-centered instruction: customize and demonstrate learning(Progressive ed.)
- Collegial activities…panels. Allow the faculty to practice, often. Customize the training to meet their needs.

- Patience & non-threatening practice. Allow faculty, adult learners, time to learn and many opportunities to practice.

Content

The questions that will guide planning for content are…

- What do faculty need to know about?
- What do administrators need to know about?

Faculty

Just as you, the planner of instruction for faculty need to consider four factors of learning, so do your faculty need to learn about, understand and address four factors of learning in the instruction that they plan and implement. Once again, four factors of learning are media, assessment, instruction, learners' characteristics, administration, & advising

Administrators

For administrators focus on three elements of leadership: management, team-building, and creating the future. These are suggested by Sullivan and Harper in their book, "Hope is Not a Method," in which they discuss how the armed forces were reorganized from dealing with predictable conditions to unpredictable conditions.

Part 4: Realities

You may still be wondering, "Is this all possible?" Gilbert (1978) has suggested three areas that must be accounted for if competence is to occur. In this case, these conditions need to be addressed in order for faculty development to occur. The areas are contributed to externally by the institution and internally by the individuals aspiring to competent behavior.

The Model of Competence suggests the external and Internal provisions of the following conditions:

- Motivation & Incentives
- Equipment & Ability
- Information & Understanding...and training

In application, the model can be completed as follows. The institution provides incentives, equipment, and expresses expectations. The individual becomes motivated, adapts for competency, and learns.

- Costs
- There are a variety of costs involved.
- Effort
- Personnel
- Time
- Restating the mission

Not all costs are directly financial.

One cost in restating the mission may be the most motivating: giving value to the learning that professionals do.

Part 5: The Future

Your endeavor may result in the following…

- Unique program
- Change in way of life
- Achieved goals

Several models relevant to planning a faculty development program were discussed in the context of an instructional design model. The discussion followed a sequence from developing a vision to looking at past practice to implementation to reality checks to the future. Some points that deserve restating: a faculty development program requires an institutional change, the implementation requires a vision as well as effort as would be expected of any successful and rewarding effort. To paraphrase a chief of the Oglala Lakota Native Americans, "…vision with work is only a dream; work without a vision is a drudgery, but together they can change the world…."

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Collaborative Cultural Studies over the Internet; Learning Cultures with Virtual Partners

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Introduction

"Culture is a complex, abstract, and pervasive matrix of social elements that functions as an all-encompassing form of pattern for living by laying out a predictable world in which an individual is firmly oriented."
Richard Porter & Larry Samover

Offering a predictable world and orienting students in that controlled environment offer the faculty a new level of challenge. Technology makes this task possible. The ultimate goal of this project challenges us to create and provide a communicative environment in which is most natural to L2 and C2[14]. We seek to teach in the world where the instructors and students coexist in non-artificial simulation.

The computer-assisted classroom is no longer a simulation, but a real life. The idea of "Learning can be undertaken in state-of-the-art classrooms, but can also be integrated into the living arrangements" (Gilman) is obsolete. In 21st century life, our lives globally connect to each other with technological network. The networked life is the living life. In that environment, one of the most important issues is the understanding of L2 and C2 to make successful communications.

Since the fall semester of 1995, students at Baylor University taking Japanese and students at Tokyo Institute of Polytechnics have had opportunities to communicate each other and learn together at in a real-world situation. Until the fall 2000, the format limited them to e-mail communication. Today, we have begun a new adventure in learning culture and communicating appropriately with the colleagues from the other side of this planet using other Internet tools.

Software and Hardware Used

Communication software, iVisit, utilizing web-based camera provides an instant visual, oral, and aural transoceanic communication along with text chat. This method brings a classroom halfway across the globe next door. We use this web-based free-of-charge software in the introductory and concluding discussions. Due to our hardware limitation, each school used one web-based camera.

FirstClass offers students to communicate in the manner of a bulletin board service. It allows students to leave messages, possibly enhanced with graphical and audio files, anytime of the day from anywhere in the world. It allows students to read the postings and share ideas. Contrary to iVisit, FirstClass gives time to students to think and examine what to post. The client software is free-of-charge and supports many different platforms and languages.

Criteria

For this study, Baylor University selected the parameter range of students to be 3rd semester, 150 contact hours, or higher. Tokyo Institute of Polytechnics has selected students from Intercultural Communication Studies who have been studying English for at least 6 years. Students from both universities interacted in L1 and L2 to complete the task.

The Project Time Table

1. Introductory iVisit session

At the end of September 2000, the first iVisit session took place. Baylor class met at 7p.m. to accommodate the time difference of 14 hours. Students answered Pre-Project questionnaires to examine what technological and cultural experiences they have had and how those experiences will change them at the completion of the project.

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[14] L1 is the first language and L2 is the second language. C1 is the culture of the students own, and C2 is the culture which student is learning as the second culture.

During this one-hour introductory session, instructors shared the intention and schedule of the project first. Then many students took the opportunity to introduce themselves and asked some questions such as weather, fashion fads, popular music, politics, and other current events. Some questions were prepared and others were spontaneous.

2. Research in C1

The myth exists among Japanese that folks in Texas still use horses as the main transportation and chases and feeds livestock all day. Then there is a myth among people in the U.S. that Japanese still walk around with katana swords in their sash and drink sake with geisha girls. Although such misunderstanding exists, students have very shallow understanding of their own culture to help others understand the truth. Therefore we assigned students to research in C1 to deepen their knowledge before learning C2 any further. Japanese students took the subject of bushi/samurai while U.S. students researched cowboys.

Due to the great number of students involved in this project, the students were divided into six groups; history, jobs, appearances, life style, culture, and beliefs and spirits. By mid October 2000, students posted their research results in assigned rooms on FirstClass server in Tokyo. We chose students to post their messages of C1 in L1.

3. Read in L2 and learn C2, then post

Students read the posted messages in L2 and learn C2. Then they are required to post a response, including a question, in the mixture of L1 and L2 by the end of October 2000. The interface of FirstClass is very similar to that of many popular email applications. Therefore, it is user intuitive and user friendly.

4. Read and post in the mixture of L1 and L2

By middle of November 2000, students have read the comments and questions toward their research. These comments and questions required further research in C1. By this time the communications are getting less formal. Students are developing healthy friendship within their small groups. We encourage students to correspond as much as they prefer.

5. Concluding iVisit session

At the beginning of December 2000, we conducted a farewell iVisit session. Students from U.S. met at 6 p.m. to accommodate the time difference. (A cultural lesson, meeting time in U.S. changes by one hour since there is no Daylight Saving Time in Japan.) The excitements fill the both rooms to meet their cyber friends from their small groups and finally put the name and face together. Students filled the Post-Project questionnaires consisting 44 questions, to complete this project.

Five C's

> *"Culture is not the people but the communication that links them together."*
>
> Mary Jane Collier

Our goal is to see how students can learn C2 through their communication in more realistic way through technology. In order to complete this approach, we must consider and examine the Five C's and apply this idea to enhance learning.

In the first C, *communication*, we use iVisit to encourage and enhance students' speaking and listening skills. In contrast, during FirstClass sessions students mainly applied their reading and writing skills. Many students enhanced their FirstClass presentation with visual and aural communication tools, such as sound and graphic files to deepen the communication.

As mentioned earlier, this project is not only learning C2, but begins from examining C1. This enables the complete reflection and learning of *cultures*. Examining and understanding oneself only enhances understanding others. FirstClass sessions allowed students to examine the myth and find the truth. iVisit sessions filled students' appetite with better understanding of contemporary popular culture.

As students learn another culture in a language class, there is an opportunity to make *connections* to other academic fields. The following chart indicates some of what students had shared and learned throughout the project.

	iVisit	FirstClass
Politics	Discussion of contemporary agenda	Political system from the appropriate era.
History	N/A	Cowboys and Samurai
Music	Discussion on contemporary music	Music that cowboys and samurai listened.
Art	Contemporary fashion fads.	Paintings depicting the appropriate era were shared.
Literature	N/A	Appropriate literatures were shared.
Sociology	Experiencing such traits as tardiness and shyness of students make a reflection to its culture.	Fashion, jobs and other related issues were discussed.

From entire project students received opportunities to make *comparisons*. One way is to compare and contrast now and then. It is done in different subject fields, which we discussed previously as a part of connection. Comparison of C1 and C2 within the particular time occurs concurrently. These comparisons take place during both iVisit and FirstClass sessions.

Then *C1* < > *C2*
/\ /\
\/ \/
Now *C1* < > *C2*

To provide *Communities*, we used iVisit for its visual, oral, and aural communications. This community was a large community where students shared one camera, one microphone and one screen. FirstClass clients were more intimate. It used small groups for the reading and writing communities. Individual involvement became more crucial in this exercise. Yet we realize that a true global community evolves during the project. Both software can be used from anywhere in the world.

These five c's take significant part of this project. Each c depends on each other to make this collaboration effective. Only when these five c's become interactive, this project claims success.

Data

Since the first semester, all of the targeted Baylor students have already been assisted on their language acquisition by computers from their "E-mail Penpal" programs. However, their change in opinion and attitude toward computer-assisted-learning has not yet been measured until now. Students have and will complete two questionnaires for this collaboration. One must be taken before the project and the other immediately after completion of the project.[15]

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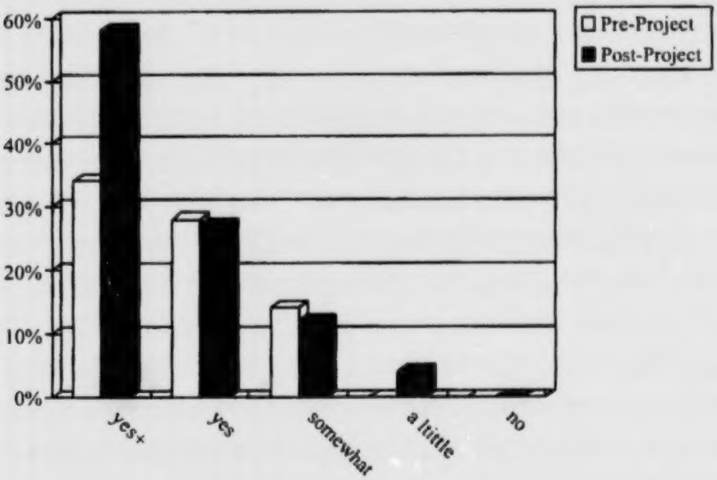
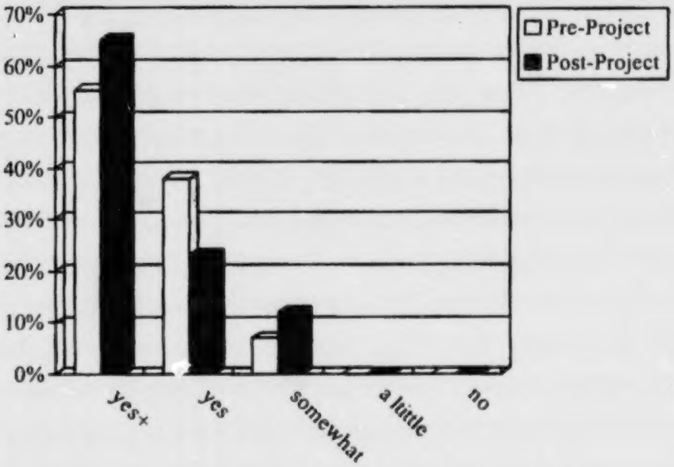
[15] Questionnaires are available for the viewing purpose only at http://www.baylor.edu/~Japanese/interculture.html.

Although current result limits in accuracy to determine its outcome from the data of only one project, preliminary data result from Baylor students show the effectiveness of computer-assisted acquisition. In asking, "Do you think computer is a useful learning tool in academic setting?" clearly there is an increase in recognizing the usefulness and effectiveness in application of technology in education during one semester.



Another interesting question asked, "Are you interested in foreign cultures?" The interest in foreign cultures increased after experiencing this collaborative project. Therefore, as predicted, the technologically enhance culture-learning collaboration place learners in positive and predictable communicative world in which learners must experience to acquire another culture.



On the Japanese side, the questionnaire results show no statistically significant change of attitudes among students. However, quite a few post project comments from these Japanese students tell that they became able to perceive their virtual partners as real persons and build a kind of relationship that promotes learning. The *importance of* personal relationship for network-based learning programs has been suggested by several Japanese researchers, and this study meets such a claim.[16]

Problems to be solved

As with any project, we can expect some problems. The problem, which we cannot resolve, is the time difference during iVisit sessions. 14 or 15 hours in time difference, depends on the Daylight Savings Time, becomes a menace. Another problem in iVisit session is the poor connection speed. The poor connection speed will result in jerky and dropped video and audio feed. Another result of the poor connection speed is the extreme reverberation of audio feed which disables the recognition of the language.

Limitation in the number of video windows forces us to use only one camera. It would be ideal to have all 30+ students to appear in individual windows. But software issue and connection speed limits us to perform at that level yet.

In FirstClass neither the time nor connection speed raise serious concern. The limitation in number of students who can login simultaneously brings a serious concern. This problem disables to login to FirstClass server as an individual during a class and has discussion on particular postings.

Conclusion

After all, "*when we are merely being ourselves, acting according to our deepest instincts, human being reveal fundamental differences in what we all tend to think of as normal behavior.*" (Storti) Communication errors easily and rapidly occur in our networked life. Strangers from all over the world gather in the online community. Without proper understanding of cultures, the behaviors progress inappropriately.

Five c's take an important role in teaching culture in foreign language courses. In the acquisition of language and culture, the technology assists teachers to offer innovative and effective method of educating. Technology aids *communication*, assists to learn *culture* of L2, make *connections* with speakers of the target language, provides *comparisons* between L1-L2 and C1-C2, and offers to participate in *communities* using languages other than L1.

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Selection of learning tasks based on performance and cognitive load scores as a way to optimize the learning process

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Abstract

To attain highly efficient instructional conditions, it is important to adapt instruction to the individual trainee. This, so-called, personalisation of training by dynamic/automatic task selection is the focus of the present paper. Recently, cognitive load measures have been proposed as a useful addition to conventional performance measures like speed and accuracy. The combination of conventional performance measures and cognitive load measures can be used to obtain information about the mental efficiency of instructional conditions. We argue that the dynamic/automatic selection of learning tasks on basis of mental efficiency will have a significant influence on the optimization of the learning process.

1. Introduction

People are faced with increasingly demanding working environments in modern society. The time constraints are increasing and task environments are getting more complex. People have to master complex working skills quickly and efficiently, because training time is often limited and mistakes can lead to dangerous situations and high costs, especially in technical domains such as aviation and industry. One way to meet these requirements is to create more efficient training by personalizing instruction

The primary goal of this article is to argue that task selection based on mental efficiency optimizes the learning process. Mental efficiency is a combined measure that uses information on performance measures and cognitive load measures (Paas & Van Merriënboer, 1993). Existing Intelligent Tutoring Systems (ITS) only use performance measures as a determinant for task selection. Although cognitive load sometimes is measured, it is not used as a determinant for task selection

In this article, we will first give a review of various task selection approaches. We make a distinction between static and dynamic task selection approaches. In both procedures the training is based on the trainee's prior knowledge. However, the selection of a set of learning tasks can either be chosen by the teacher/trainer prior to the start of the training (static procedures) or can be adjusted during the training (dynamic procedures).

It has been proposed that when teaching student complex cognitive skills, part-task training can have a higher learning efficiency and reduced training costs than whole-task training (Wightman & Lintern, 1985). We will use the whole-task and part-task approaches as subcategories for static and dynamic selection, yielding four approaches. These are static whole-task approaches, static part-task approaches, dynamic whole-task approaches, and dynamic part-task approaches. Then a new approach using mental efficiency in a dynamic whole task procedure will be presented. Finally, we will discuss this approach.

2.1 Static whole-task selection approaches

The elaboration theory (Reigeluth & Stein, 1983) states that one should start with the simplest kind of typical task that an expert would perform and to gradually progress to more complex tasks. All the tasks in the training are whole-tasks. Furthermore, the sequence of the tasks in the training is preset before the training.

The elaboration theory makes a distinction between task expertise and domain expertise. Recently, a new approach, the Simplifying Conditions Method (SCM), for building task expertise has been developed. It offers guidance for analyzing, selecting, and sequencing the learning tasks. Given that any complex task has some conditions under which it is easier to perform than under others, a SCM sequence begins with the simplest version of the task that is still fairly representative of the task as a whole. Then it gradually progresses to more complex versions of the task until the desired level of complexity is reached, making sure that the learner is aware of the relationship of each version to the other versions. Each version of the task is a class or group of complete, real-world performances of the task (Reigeluth, in press).

- Another new approach, called the familiarity approach, uses the prior knowledge (familiarity) of the trainees and the difficulty of the tasks to base the training sequence on (Scheiter, Gerjets, & Tack, 2001). The first lessons or parts of a training contain high familiarity and are of low difficulty. As a learner progresses through the lessons or training, familiarity decreases and difficulty increases.

The SCM and the familiarity approach share many aspects. Both approaches, rightfully, claim that the training should be adjusted to the prior knowledge of the trainee. After having correctly performed a task of a low complexity, the complexity is gradually increased during the training. Note however, that the training has been preset and the sequence of the tasks in the training is not subject to any change. These approaches do not adapt to the needs of the individual trainee. They only adapt to the prior knowledge of a target group and not specifically to each individual learner before the training starts.

2.2 Static part-task selection approaches

Wightman and Lintern (1985) have proposed that when teaching students complex cognitive skills, part-task training can have a higher learning efficiency and reduced training costs than whole-task training. Segmentation is one of the three of methods of task decomposition that were discussed and evaluated by Wightman and Lintern (1985). Segmentation involves partitioning a whole task into components along spatial or temporal dimensions. Prior to the training the size of these components is adapted to the prior knowledge of the trainee.

A well-known method of segmentation-based training is backward chaining, in which the last component of a task is practiced first and earlier components are introduced later in the training (Proctor & Dutta, 1995). Benefits of backward chaining in comparison to whole-task training may originate from the role of knowledge of results (KR) in learning (Wightman & Lintern, 1985). Wightman and Lintern (1985) have suggested that, as a result of training, the perceived competency in performing the final task component can act as KR for the preceding components, thus facilitating learning of earlier components of the task.

Ash and Holding (1990) found that forward chaining, in which the order for adding task components is first to last, was more effective for learning selective keyboarding skills. Forward chaining may sometimes be superior to backward chaining because in this method task component-completion feedback is always proximal to the component task being introduced (Proctor & Dutta, 1995).

An approach that is linked to segmentation is the blocked versus random scheduling approach. These part-task sequencing methods have been contrasted with each other in numerous studies (e.g., Carlson & Yaure, 1990). The random schedule contained four rules intermixed from trial to trial within practice blocks, compared to the blocked schedule that contained only a single rule appearing repeatedly with each practice block. It was found that acquisition performance for a set of individually presented component skills was better when the components were practiced in a blocked schedule than in a random schedule. However, retention and transfer performance was better following a random practice schedule. These results have been replicated by Lundy, Carlson, and Paquiot (1995).Their explanation for this finding was that random practice provides a richer set of cues for distinguishing among the items in a set. This results in more accurate retrieval of a particular item from long-term memory. The richer set of cues is another way of saying that the variation was higher. They furthermore reasoned that rule-specific processing occurred in the blocked schedule and that relational processing occurred in the random schedule. Rule-specific reasoning emphasizes the need to reconstruct rule-like procedures in working memory. Relational reasoning emphasizes the opportunity to compare multiple representations, thus making relations, in working memory. These two processes resemble the rule automation and schema acquisition processes that were identified by van Merriënboer and Paas (1990).

The hierarchical approach that was developed by Gagné (1968) also is a static part-task approach. It is based on the observation that a skill is made up of simpler "component skills" that you must learn before you can learn the larger, more complex skills of which they are a part. Gagné distinguished five intellectual skills that are increasingly detailed and difficult. At the bottom level there are discriminations, followed by concrete concepts and defined concepts, at the next level there are rules and at the top level there are high-order rules. The hierarchical arrangement of these five skills helps one to figure out what the prerequisites a given skill might have. To make sure the learner is not confronted with learning tasks of skills that (s)he already has mastered, the training needs to be started at the level of "entering knowledge" of the learner. A hierarchical sequence is one which never teaches a skill before its prerequisites (Gagné, 1968).

All three approaches, rightfully, claim that one should adapt the training to the trainee's prior knowledge. And like the hierarchical approach states, some skills should be learned before a trainee can start to learn a more complex skill. However, none of the approaches allows adaptations to the individual trainee to be made during the training.

2.3 Dynamic whole-task selection approaches

The last decade, dynamic approaches have been widely used to adapt more efficiently to the needs of the individual trainee. It is possible to respond to the learner's problems during the training, with decisions being made that are typically based on the performance of the trainee.

In order to keep track with the trainee's history of the tasks and the correlating performance, many ITS (Intelligent Tutoring Systems) use a student model. A student model builds a knowledge base of the trainee, and updates that knowledge as the trainee progresses through the tasks of the training. Certain learning objectives have been specified prior to the training, which are used to check the progress of the trainees. Performance measures are collected and are compared to the learning objectives. After this comparison, the selection rules indicate the next learning task to present to the learner.

However, many approaches focus on elaborating the operationalization of student modelling while not being clear on the selection rules that are being used. These approaches include psychometric approaches (for a discussion, see Everson, 1995), agents (e.g., Capuano, Mersella, & Salerno, 2000; Giroux, Leman, & Marcenac, 1995), and fuzzy logic (e.g., Virvou, Maras, & Tsiriga, 2000). Mostly, the primary function of student models is to give specific feedback to the learners about their performance. An ITS that explicitly describes the selection rules that are being used is CASCO (Completion Assignment Constructor). CASCO is an ITS for the dynamic construction of assignments to practice introductory programming (Van Merriënboer, Luursema, Kingma, Houweling, & De Vries, 1996). Based on different actions of the trainee, CASCO can decide whether the trainee has learned the programming skill or not, can adjust the amount of presented information by increasing or decreasing information in the completions tasks, and decide to either delete or add the program code, explanations, questions, and instructional tasks (Van Merriënboer, & Luursema, 1995).

CASCO uses several straightforward selection rules. The most important rule states that a good problem is suitable to present new learning elements and to practice known learning elements. CASCO could therefore be classified as a Progressive Mental Model (PMM). The other rules state that a good problem is not too difficult, has not been presented to the learner before, and is suitable to remediate learning elements the learner makes mistakes with.While the learner is working on an assignment, student diagnosis takes place in order to update the student model. The learner's results on questions and instructional tasks form the input of student diagnosis. For all learning elements that have already been presented to the learner, the so-called Expertise and Incompetence are computed (Van Merriënboer, Krammer, & Maaswinkel, 1994). Expertise indicates the learner's proficiency in correctly using a particular learning element, while Incompetence indicates the learner's tendency to make errors with a particular learning element. For each learning element, the Expertise and Incompetence are further modeled as fuzzy sets. The truth value of the membership of those sets may range between 0 and 1. To keep track of the students' progress two sets have been developed. The Learning Set, which contains the learning elements that the learner is already practicing but has not mastered yet. And the Incompetence Set, which contains the learning element that the learner is already advancing in but still makes mistakes with (Schuurman, 1999).

It is common for ITS to base their student model and task selection on performance measures like speed and accuracy. We argue that it is important to use mental effort as an additional determining factor because different students can attain the same performance level with different amounts of invested mental effort.

2.4 Dynamic part-task selection approaches

The first dynamic task selection approach, in a very raw version, was branching. This part-task approach attempts to diagnose the learner's response, usually on the basis of a multiple-choice question. The training starts with offering pieces of information and during the training more information is added with each next step until the trainee reaches the state where the whole task can be performed. This process is also known as snowballing (van Merriënboer, 1997). After the learners have been presented a certain amount of information, they are given a multiple-choice question. If they answer correctly, they branch to the next body of information. However, if they are incorrect, they are directed to additional information, depending on the mistake they made (Clark, 1997). The amount of branching may vary considerably, from occasional branch points to branching after every student's response. Branching can be based on individual performances, cumulative performance, or student choice. The direction of branching can either be forward, sideways, or backward. Forward means that the learner skips information that most students see. Backwards means that the learner is returned to repeat instructions. And sideways means that the learner is exposed to extra information that most learners skip (Allesi & Trollip, 1991).

Most of the research on branching has been done in the 1960s and 1970s. Although the theoretical foundation is good and makes sense, the practical part of proving the superiority of branching over normal fixed sequencing appeared to be difficult. There are several studies that showed evidence in favor of the branching sequence over a fixed sequence (Coulson, Estavan, Melaragno, & Silberman, 1961; Hurlock, 1972; Slough, Ellis, & Lahey, 1972), but most studies fail to show a superior effect of branching (Campbell, 1962; Glaser, Reynolds, & Harakas, 1962; Holland & Porter, 1961; Lahey, 1973). It was stated that the Computer Assisted Instruction programs usually consisted of a simple algorithm for branching among a few fixed alternative questions. Such rigid plans do not provide a model of how a tutor can adapt the generation of tasks to suit the particular needs of each student (McArthur, Stasz, Hotta, Peter, & Burdorf, 1988). Furthermore, the costs and time needed to complete a part-task training are mostly very high.

3. The use of mental efficiency in a dynamic whole-task selection approach

Our approach incorporates various elements of the discussed task-selection approaches. Like in the whole task approaches we start with the simplest version of a whole task. The complexity of the training should be adjusted to the trainee's prior knowledge. In other words, the familiarity should be at an appropriate level. All the versions of a whole task are categorized in learning tasks which gradually increase in complexity in respect to each other. The trainee starts with the lowest complexity and proceeds to the highest complexity, while the pace of the progression depends on performance and cognitive load measures. Like in CASCO (e.g., Van Merriënboer, Luursema, Kingma, Houweling, & De Vries, 1996) we can adjust the amount of information that is presented to a learner. Dependent on the learner's performance and load, the information can be decreased, kept constant, or increased. Furthermore, as in the dynamic approaches we can select learning tasks during the training and adjust to the individual learner's needs during training.

Another characteristic of the approach is that instead of presenting more whole tasks, it can be more efficient to present part-task training for the part of the task that the trainee has not mastered yet. Consider for example learning how to drive a car. If a trainee has mastered steering skills, gas-and brake skills but still has not mastered the shifting gear skill, then this skill should be practiced in isolation until the required performance level has been reached. With part-task training of this component the costs in terms of cognitive capacity will decrease and the learner will be able to acquire the whole task more efficiently.

Cognitive load has been acknowledged as an important factor in the training of complex cognitive skills. When learners acquire simple skills, cognitive load only plays a minor role. A badly designed training does not necessarily have negative effects because learners can invest mental effort to compensate for the bad design. However, when learners are presented with a training of complex skills, they are not able to so anymore. They do not have mental effort for this purpose because the training generates a high cognitive load upon the learner's capacities. Students can attain a high performance but with varying amounts of load. By taking cognitive load into account the decision in task selection can lead to optimal individual learning. Learners attain the highest performance when they have to invest an optimal amo unt of load. Therefore, we propose to use performance measures in combination with mental effort measures for dynamic task selection. A procedure for combining mental effort and performance measures in a measure of mental efficiency was described by Paas and van Merriënboer (1993). The efficiency measures take differences in cognitive capacity, expertise, and motivation into account. The use of mental efficiency is expected to make the individual training more efficient, and to lead to better transfer results.

A first confirmation for this claim was found in a study conducted by Camp, Paas, Rikers and van Merriënboer (2001). They compared four methods of task selection in the domain of air-traffic control. Learning tasks could be presented in a fixed order from simple to complex, or the selection could be based on performance, mental effort, or the combined measure of both, mental efficiency. Although, they did not find differences in transfer performance as a function of learning task selection method, the results showed that participants in the mental efficiency condition were confronted with high variability of learning tasks, and that participants in the performance condition were confronted with low variable learning tasks.

We believe that our approach is a promising one. It takes more information about the learner's learning progress into account than the conventional approaches. Mental efficiency combines performance measures and cognitive load measures on which the task selection decisions are based. Furthermore, tasks can be presented in different formats to the trainee. Dependent on the mental efficiency of a previous task, the decision can be made whether the learner support can be decreased, kept constant or increased. The variability is high, which means that trainees will be exposed to various analogies that induce schema acquisition. Because of the higher training efficiency, trainees participating in our approach should also be able to reach better results on transfer tasks. We are currently developing more experiments to obtain more evidence for the expectation that our approach indeed leads to more efficient individualized training.

4. Discussion

The goal of this article was to argue that task selection based on mental efficiency is a promising approach for optimizing the learning process. In order to reach this goal, we first gave a review of various task selection approaches. We made a distinction between static task selection approaches and dynamic task selection approaches. Within these main approaches, a distinction was made between whole-task and part-task approaches. The resulting four approaches were static whole-task approaches, static part-task approaches, dynamic whole-task approaches, and dynamic part-task approaches. The static whole-task approaches including the familiarity approach (Scheiter, Gerjets, & Tack, 2001) and the elaboration theory (Reigeluth & Stein, 1983) claim that the training should be adjusted to the prior knowledge of the trainee. After having correctly performed a task of a low complexity, the complexity is gradually increased during the training. Our main critic on the static aspect was that the training has been preset and the sequence of the tasks in the training is not subject to any change. In this situation it is impossible to optimally adapt to the needs of the individual trainee, especially during training.

The static part-task approaches, including segmentation (Wightman & Lintern, 1985), blocked vs. random schedules (e.g., Lundy, Carlson, & Paquiot, 1995) and the hierarchical approach (Gagné, 1968), showed that part-task training can be useful at some occasions. However, because of its high costs and long duration, we propose to use part-task training only as an additional part of whole-task based training. The static aspect of the part-task approach also was criticized for its inability to adapt efficiently to the learner's needs during training.

Dynamic whole-task approaches including Intelligent Tutoring Systems (ITS) have been focussing on the operalization of selection rules. Many articles describe the functionalities of their student models in great detail but do not explicitly describe the selection rules that have been used. CASCO was identified as an exception to this rule. Our main critic on dynamic whole-task approaches was that they only use performance as the determining factor for task selection. We argued that cognitive load can provide additional information about the learning progress of a trainee.

Dynamic part-task approaches including branching (e.g., Campbell, 1962) were the first to try to diagnose the learner's response. However, the programs that used branching usually consisted of a simple algorithm for branching among a few fixed alternative questions. This does not enable one to efficiently adapt to the particular needs of each student (McArthur, Stasz, Hotta, Peter, & Burdorf, 1988).

Instead, we suggested a mental-efficiency based dynamic whole task procedure with the possibility for additional part-task training. Task selection is based on a combined measure of performance measures and cognitive load measures called mental efficiency. Furthermore, the sequence of the learning tasks is not preset but is dependent on the mental efficiency of the individual trainee. It is important to adapt instruction to the individual learner to attain efficient instructional methods. Preliminary evidence for the success for the use of mental efficiency in dynamic task selection was found in the study of Camp, Paas, Rikers and van Merriënboer (2001).

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Towards the Transformation of Higher Education: Educational Technology Leadership

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Abstract

This paper focuses on the management and change domains of educational technology, namely the need for educational technology (ET) leadership in higher education. Leadership issues are examined with respect to instructional development, faculty development, and instructional technology/media management in higher education and the roles ET practitioners can play. Other topics include: a description of the transformative process underway in higher education driven by technological innovations; raising awareness of the need for ET practitioners and doctoral students to aspire for administrative leadership positions for effective policy formulation, strategic planning, management, evaluation, and implementation of instructional development; and discussion of the essential skills and strategies for achieving ET leadership in colleges and universities.

We are in favor of ET professionals going beyond providing basic services or merely running equipment distribution units. We advocate leading the change in instructional development, technology integration in the learning process, managing resources and effectively collaborating with faculty in designing instruction. We advocate for positions that will permit the ET professional to work with institutional leaders in policy-making and in planning for instructional technology deployment, faculty development, and instructional development.

The term ET professionals is used to refer to individuals with formal training in the field of educational technology, instructional technology, instructional media, instructional systems, educational communications and all related areas, and who have work experience in the field.

Introduction

"The real question is not whether higher education will be transformed but rather *how* and *by whom*." —James J. Duderstadt (1999)

The emergence of new technologies lead by the popularity of the microcomputer and the ubiquitous nature of communication technologies has brought significant changes to the field of educational technology (ET). These changes are acutely felt in higher education, where Duderstadt (1999) envisions a significant transformation during this decade as colleges and universities respond to their internal changes (Katz, 1999) and the needs of a rapidly changing society (Surry, 1996; Surry & Robinson, 2001). Some notable changes in higher education include: requirements for all students to own laptop computers; incentives for professors to integrate technology into their courses; wireless network campuses; and classrooms equipped for multimedia learning. Technological innovations, in general, are not new, but the accelerated rate of change is moving towards a knowledge-driven future for which many colleges and universities are struggling to prepare.

The rapid changes in technological innovations we are witnessing all around us today are affecting educational institutions and are fundamentally changing the educational needs of society (Surry, 1996). There seem to be the lessening of the initial resistance to the adoption of the new technologies in higher education. The effects of the change induced by the technological innovations in higher education are becoming obvious. Change is not a new phenomenon as most organizations go through such experiences. Change in higher education is inevitable and as Duderstadt (1999) pointed out "the real question is not whether higher education will be transformed but how and by whom". The change, in part, is brought from the outside by technological forces (Daft, 2001). As noted by Siegel (1999) and Doll (1993), higher education is a complex and chaotic social system. The complex nature of higher education has affected the manner and method of adopting the new innovation. Equally, the influence of technological innovations has affected the way business is done in higher education. Some of the areas that have been impacted by the innovations are, faculty training in the use of technology in teaching, innovative learning with technology, and the management of technology in higher education. Administrators in higher education are doing their best to manage the change process.

Faculty are key stakeholders in the adoption of educational technologies since the changes brought about by such innovations affect either the way students learn or how instructors teach. Campus officials have consistently rated assisting faculty with technology integration as one of the most important information technology issues challenging higher education (Green, 2000). Units that support faculty in their instructional roles, such as audio visual services, instructional media centers, faculty development centers, and centers for teaching excellence, are also undergoing changes in organizational structure, technologies, and functional operation to meet the emerging needs of an educational technology powered campus. Administrators within these units are facing dual challenges to manage a dynamic change process and handle the educational technology innovation. Fullan (1993) and Sparks (1993) assert that leaders in educational institutions need to understand the change process in order to effectively lead and efficiently manage the transformation currently underway. To assist both faculty and administrators in this process, ET practitioners can provide leadership in the adoption and use of technology for the improvement of teaching practice and learning processes.

ET professionals in the field

In a speculative article on the roles of educational technology practitioners in the year 2000, Bratton (1988) wonders if there will be many in this field who will rise to leadership roles. Surry and Robinson (2001) found that many colleges and universities are actively recruiting for positions that require educational technology skills. While most of those positions are for instructional technologists, a few are at a high level of ET leadership, such as director, dean, or vice president of an academic computing unit. Surry (1996) reports that educational technologists are steadily being hired in higher education and in a recent study by Surry and Robinson (2001) they categorized numerous current educational technology job postings. Albright (1995) also reported that administrative positions in higher education are being advertised. This is unprecedented and could be attributed to the technology revolution. However, an important question is, are these positions, particularly those for senior managers, directors, deans, and assistant vice president positions, being filled by ET professionals?

Who is leading?

Many graduates of educational technology programs who hold the master's or doctorate degree seem to take up positions as instructional designers or faculty teaching positions in colleges and universities with titles such as: Instructional Technologist; Instructional Designer; Distance Learning Co-coordinator; Instructional Technology Manager/Administrator; Technical Support Specialist; World Wide Web Specialist; and Instructional Technology Librarian (Surry & Robinson, 2001). As a consequence, the early periods of technology revolution saw them still in their "traditional" roles rather than taking up positions to direct or influence the adoption of innovation in higher education. Such roles are non-agenda setting (Surry, 1996). This is not to say that the positions they hold are inadequate for leadership, however, they may be limiting in terms of the influence they have in directing educational policy issues and in influencing change. The current roles held by ET practitioners can be the starting point for advancement to higher-level administrative and policy-setting positions that provide platform for greater influence on the transformation of higher education.

The technology revolution has created the need for educational technologists in almost every sector of the economy including higher education. Albright (1995), comments that, "in fact we are seeing significant evidence of administrative recognition (with) position announcements for a director or dean to administer a composite of campus-wide educational technology services" being advertised. That is good news for practitioners in this field. Additionally, Surry (1996) reports that educational technologists are being steadily hired in higher education; however, the responsibilities, functions, and qualifications required for these roles are not properly defined. The same question remains, are these positions being filled by ET professionals? While these positions are being advertised, it will be interesting to find out if they are being filled by ET graduates or otherwise by faculty members from different disciplines. Anecdotal evidence suggests that many individuals filling these positions have not had the academic training in educational technology. Faculty from other disciplines seem to dominate administrative leadership and management roles regarding instructional development within colleges and universities, as well as faculty development areas. The implications are that decisions and policies regarding technology integration in the classroom, helping faculty to improve teaching, and the instructional development process across all academic disciplines in higher education are not made by those trained in educational technology.

Wright (1997) found in a study of faculty and instructional development programs in higher education that leaders in these areas seem to emerge from the faculty ranks, irrespective of their primary academic discipline or previous experiences. The study confirms the notion that the appointments to such leadership positions are usually filled by faculty, who are prepared as specialists in their various fields with little or no training in leadership, technology use, and in the process of teaching and learning (Bates, 1999; Noone & Swenson, 2001). Most are not trained as educational technologists. Therefore, faculty appointments to top ET positions may be the result of a long-standing perception of the roles of ET practitioners by faculty and higher education administrators. Whereas faculty have maintained a strong position as leaders in academic matters, ET practitioners are perceived as providing services to support instruction (Heinich 1995). There seems little room for faculty to negotiate or share the roles. Administrators in higher education do not appear to have demonstrated enough understanding of the roles or potentials of ET professionals.

The Need for Leadership

At any level, there remains a significant role for an educational technology leader in higher education to guide faculty innovations, work collaboratively with faculty and administrators, and lead the efforts towards educational technology change in higher education. As the transformation progresses, faculty need training in the skills that are essential for teaching and learning and with technology, support during the development process, and advice for the effective integration of media and information technologies. While a few ET practitioners in colleges and universities have advanced to leadership positions, entrenched institutional policies and practices unique to higher education present challenges to overcome (Bates, 1999; Green, 1999; and Duderstadt 1999).

A survey of instructional development, academic technology, faculty development, and media services programs in higher education reveals a need for leadership and management of these programs. It does appear that a problem that Spitzer (1987) raised (reported in Galbraith et al, 1990) still persists. Spitzer identified three factors he "believes explain why educational technology has not achieved its potential." One of the reasons he identified was the leadership problem, that is, the dearth of people who will lead to moderate the "quagmire of individuals, groups, and interests that claim a part share in the educational technology enterprise". He noted that a major managerial/leadership gap has not been bridged. Seels and Richey (1994) describe management as one of five domains of the instructional technology field. Galbraith, et al. (1990) add that, "The successful application of technology in education depends not so much on the technology, but how it is managed" A recent study by Johnson (2001) that looked at issues in academic technology leadership in higher education found few ET professional in top leadership positions. Bates (2000), who visited several colleges and universities during a study, states this case precisely and succinctly, "In all the organizations that I visited where technology was being used successfully for teaching, strong leadership was a critical factor. Without leadership and a strong sense of support for change in an organization, the barriers of inertia will be too great".

Effective management of the instructional development process and technologies used in instruction, and the preparation of faculty, will likely result in the efficient use of the technologies, and in the improvement of both teaching and student learning processes. Management implies leadership and by virtue of their placement in leadership positions, ET practitioners are advantageously positioned as change agents, especially as it relates to the use of technology in instruction. As a result of their preparations and understanding of educational systems change, instructional systems approach, and knowledge of learning technologies, educational technologists can exert considerable influence through technology in reshaping educational settings. Roberts (1994) argues that technology and educational reform or restructuring is "inexorably" linked and that merely deploying technology in schools cannot cause educational reform. The changes called for cannot occur in isolation or by simply acquiring new technologies. In the higher educational system, change is best implemented from within. There is need in education for systemic thinking as the newer technologies are introduced. Introducing innovation and managing change in higher education, we believe, requires individuals who have established credibility within the institution; understand the idiosyncrasies of academic environments; support the role and use of technology; respect the instructional design process, and possess skills in change.

The focus here is on leadership. We do recognize the importance of management functions and other roles that ET professional play, they are all essential for the success of the learning enterprise. While management and leadership seem synonymous, we have emphasized leadership, as many seem to agree that it provides a broader perspective, fosters a holistic view on issues, enlarges vision, engenders viewing issues from systemic point of view, and provides better opportunity for change sponsors and agents for the betterment of the organization, and such that will appeal to the organizational stakeholders. The leader directly or indirectly influences and motivates individuals with inspiring examples. Leaders are expected to shape the culture of an organization by creating new visions. Kearsley and Lynch (1994) add that the success of leaders is determined by their ability to understand and influence organizational cultural mores and values. When followed, the course that the leader charts will ultimately profit the organization, and in this case higher education. Management, though equally good, tends to focus on details in their work environments and to compartmentalize.

Unique Qualities of ET Professionals

We do believe that by the nature of their training and experience, ET practitioners can work well with faculty in improving instruction in higher education, as well as working effectively to manage educational technology change in higher education. ET practitioners can work well as change sponsors, change agents and change advocates in initiating and implementing change in higher education. Rather than be seen as encroaching into the faculty domain of instructional delivery, they can co-exist as partners in the effort for instructional development and integration of technology in instruction. To better address this issue will require an understanding of the preparation, roles, function, and abilities of the ET practitioners in instructional development and managing change. Their training focuses on instructional design and development, media use in instructional or performance improvement, educational and learning theories, technologies of instruction, as well as educational systems design. Some programs are adding change management, organizational development, and management courses. These skills equip them to view issues systemically and holistically, and to provide the appropriate interventions.

The Educational Technologist: A Change Agent for Higher Education

This seems to be the right direction for higher education in its efforts to either manage or implement successful technological change initiatives. People who are familiar with higher education seem to view the issue from the same perspective. Bates (2000) advocates that the best approach for colleges and universities is to create the position of "associate vice president, academic, with overall responsibility for academic technology issues, probably as part of a larger unit for teaching and learning." This position will collaborate with the information technology group and similar on-campus organizations to manage instructional technology, administer faculty training, and design instruction for better student learning. Dillon and Walsh (1992) identify leadership as the foundation on which change rests. Kearsley and Lynch, (1994) summarize, "Technology leadership is inherently linked to innovation and this provides unique consideration. While leadership usually involves dealing with change, technology leadership deals almost exclusively with new procedures, policies, and situations". They identified the potential benefits of good technology leadership, that includes, "improved academic achievement by students, improved student attendance and reduced attrition, better vocational preparation of students, more efficient administrative operations, reduced teacher/staff burnout and turnover". An addition to the laudable list is better support and training for faculty. For educational technology leadership, having a clear vision of how the educational technology innovation would be adopted to produce the desired changes for the maximum benefit of the institution is an essential requirement. The implications for the ET practitioner is that only when they aspire for and move into such leadership positions can they wield the necessary influence that will support the better adoption of new technologies that will have profound impact in the teaching and learning process in higher education.

Aspiring for Leadership Positions

It behooves ET practitioners to strive for the leadership positions when such positions become available. A content analysis of recent position announcements in higher education confirms other findings (Albright, 1995; Wright 1997; Surrey and Robinson, 2001; Johnson, 2001) that leadership positions are gradually opening up. As stated previously, ET practitioners hold a small proportion of the positions. Romiszowski (1994) points out that as educational technology practitioners, we have a great deal of experience in evaluating and designing systems for patrons and little experience in designing for ourselves. It appears, from current trends and the positions many practitioners hold, that many of those in leadership are not playing the sponsor role in the change process. As Salisbury and Conner (1994) point out, "to successfully champion change in education, advocates must first realize that they cannot initiate change until they have obtained sponsorship. Advocates without sponsors result in conferences and good intent but not substantive change".

Being in the right leadership position will permit the ET practitioner to function not only as change agents and advocates, but also play the role of change sponsors. The advantage of being a sponsor is that it puts the practitioner in direct control to initiate change. A change sponsor is, "a person or group who has the authority and legitimizes a change" (Lick and Kauffman, 2001). Further, the change agent is a person or group who is responsible for implementing desired change. Examples in higher education include: chancellor, VP, Dean, program/division director, among others. Lick and Kaufman (2001) advocate that leaders need to provide and implement "a detailed, structured, disciplined transition plan for identifying and completing the major change".

The roles that ET practitioners seem to have played for a long time are the roles of change advocates and targets. As advocates, they train and encourage faculty and others to use technology. As targets, they change or reposition themselves with any wave of technology for pedagogy that is in vogue. In these roles, they have lacked the authority to initiate, plan, implement, and evaluate technological change in the teaching and learning environment, in part because they are not playing the sponsor role in the change process.

For educational technology leadership, possessing a clear vision of how the educational technology innovation would be adopted to produce the desired changes for the maximum benefit of the organization is an essential requirement. Kearsley and Lynch (1994) add a perspective that the success of leaders is determined by their ability to understand and influence organizational cultures. The role of a leader is more than management of resources. As opposed to a manager, who may tend to be compartmental in their operation, the leader is more holistic and tends to view issues from a systemic perspective. Leaders are expected to shape the culture of an organization by creating new visions for organizational improvement in such a manner that will appeal to the key stakeholders. The implication is that when the ET practitioner assumes this kind of leadership position, they can then utilize the necessary influence to support effective adoption of educational technology systems in higher education

Moving into Leadership

Implications

The dual role of ET practitioners in instructional design and leadership comes with added responsibilities and calls for additional sets of skills (e.g., project management, consulting, change management) that may not be a component of the ET graduate curriculum and new knowledge domains not usually associated with educational technology (e.g., administration in higher education, educational leadership, educational theory and policy). With the necessary preparations, educational technologists can exert considerable influence through technology in reshaping educational settings.

Moving into leadership positions as they become available requires preparation on the part of the ET practitioner. Although they possess the basic skills as a result of their training, ET professionals constantly need to update their skills especially for management and leadership in order to align themselves to the opening positions. The need for constant update of skills and for the acquisition of new skills is essential in view of the constantly changing dynamics in today's work environment, including higher education (Gilliland and Tynan, 1997). This calls for change in behavior in those aspiring for leadership or administrative positions in ET to transcend the acquisitions of traditional skills and competencies for instructional designers and reach for the skills that will propel them to leadership positions. Both practicing ET practitioners and those graduating from ET programs need to be cognizant of the requirements for the new leadership positions and to prepare accordingly.

It must be mentioned that moving up to the leadership positions will have its challenges and obstacles. Such positions are often fraught with politics and thereby requires understanding and adaptation to the organizational culture (Rossett 2000). As Creth (2000) observes, "Unlike deans, department heads, and faculty in academic programs, administrators in non-academic service areas...do not enjoy the protection of tenure as they cope with the inherent risks of change." However, the problems are not more challenging than being in supervisory or non leadership positions that lack the provision of sufficient resources to discharge their duties and protection from the consequences of working in a complex environment.

Benefits

Much benefit accrues with ET professionals moving up into leadership positions. The institution, faculty, students, and the ET professionals will all mutually benefit. The processes that are likely to be put in place will better advance the missions of the respective institutions. As stated earlier, technology adoption efforts, faculty development issues, and instructional development process will be approached from systemic and holistic standpoints. Policy issues regarding these areas will involve those that understand the ramifications of the policies in the area, as well as implications of wrong policies. This will help to foster better relationship among campus groups involved in the use technology in the teaching and learning process.

Recommendations: Preparing for educational technology leadership

Before assuming any leadership role, the educational technology practitioner must be adequately prepared with a broad array of interpersonal skills and abilities in management and leadership (Surrey, 2001). Academic or professional preparations beyond the usual boundaries of educational technology should include topics in: organizational change and theory; higher education administration; educational theory and policy; workforce education; and management science and theory.

ET programs

To better prepare students to meet the new demands, educational technology programs may need to focus on those skills that will equip graduates to assume leadership roles and function better in higher education. In addition to the requirements in preparing students for faculty positions, a track may need to be established. Courses that will help students develop the requisite skills in leadership, management and understanding of organizational set ups (Rossett, 2000), change management, educational systems design, and project management. Surrey and Robinson (2001) also suggest that for those interested in positions in higher education, technological and interpersonal skills are very much desired. Some of these could be achieved by collaborating with other departments/programs to offer relevant courses or to organize workshops and seminars. These will not be added to the detriment of the core instructional development focus of the programs. Rather, it will be in addition to all those competences that have been the hallmark of educational technology programs.

ET Students

Students in ET programs who desire to move into leadership positions upon graduation may begin early in their programs to prepare. In addition to taking relevant courses, they need to be familiar with current positions, job descriptions and entry requirements as they prepare. They need to have the traditional competencies for educational technologists. It will be helpful to stay current with trends and to position themselves for the desired positions.

ET Professionals

This will lead to the expansion of the roles of ET professionals. It will result in moving from service support roles to roles that will be involved in looking at instructional and technological problem holistically. To be in a better position to be successful and to handle the challenges, ET professional will need to be prepared. Some of the possible ways to prepare include being involved in professional development, going for an advanced degree if necessary, supporting current superiors, being current, having a vision and a plan for the new career direction, and staying current in the field. Try your hands on playing leadership role before your friends and others whenever the opportunity calls. The old art of networking should not be neglected. This is not an exhaustive list but a beginning guide for the professionals.

Conclusion

Higher education is changing by gradually responding to the change brought about by technology and other related forces. Colleges and universities have a distinctive culture that characterize or define them. Equally, units within the organization, which could be described as subsystems, exhibit distinctive culture that is a result of their profession. Change resulting from adoption of learning technology will evidently affect change in other areas because of the interrelatedness of the various subsystems and the complexity of higher education as a social system. Such intricate and complex process needs to be addressed by professionals who understand the systems and can provide a holistic intervention. It is our view that ET professionals can help higher education significantly in this era of transition.

Many institutions have invested heavily in information technology, and as a result questions about the effectiveness of technology are being asked. During the period of acquiring technologies, many institutions did not have any policies or any instructional technology plan. In the early days of the new media, many institutions did not seem to have any plans as to what technologies are needed and how to use them in instruction. A lesson to be learned is that merely acquiring assorted technologies does not translate into good instruction. Equally, using technology in an adjunct or desultory manner may not achieve the desired learning outcomes. Having a sound technology plan and working with faculty to redesign instruction to accommodate the new delivery systems, under the leadership of ET professionals will be beneficial in enhancing the teaching and learning process as well as advance the mission of the institution. With the properly prepared ET professional in place, higher education will be on the road to realizing the promise of technology in this evolving era in education.

The increased involvement of ET professionals in educational technology leadership as well as other service areas will help higher education as it strives to enhance faculty teaching, and technology skills, and consequently improve student learning. The need for the preparation of leaders in educational technology is encouraged by current trends that suggest that some in the field are making inroads into the leadership and management cadre. Educational technology practitioners are gradually advancing in position, heading ET departments and holding other administrative positions.

It is hoped that this paper will draw the attention of ET practitioners, faculty, and students to the necessity to strive towards leadership positions in higher education. Educational technology graduate programs may in response develop specializations in higher education leadership and management. Increased numbers of ET trained administrators and faculty with interest in ET leadership in colleges and universities would be a boost to the field. The technological transformation of higher education will proceed regardless of whether ET practitioners are leading the change. It would be beneficial for all stakeholders in colleges and universities if ET graduates assume the leadership positions that make key decisions that, in turn, influence future generations of college graduates, ET practitioners, and hopefully faculty, who continue the cycle.

ET leaders will also help in seeking and selecting the right ET professionals who are well prepared to meet the needs of the institutions. A look at many job announcements for instructional technologist/designer position seems to emphasize more on hardware and software skill, and less, sometimes, no instructional design skills are listed. This may probably be symptomatic of the lack of understanding of the roles and functions of ET professionals and the sets of skills and competencies they bring along. ET professionals in leadership can help to address such problems, as well as work towards the standardization of job descriptions for ET positions.

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Teaching in the 21st century: A web experience

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In 1996, Bonk and Cummings set out to design, implement, and refine web-based educational psychology courses and laboratory experiences offered to pre-service teachers at Indiana University. Utilizing the American Psychological Association's 14 Learner Centered Principles (1993, 1997), Alexander and Murphy (1994), Bonk and Reynolds (1997) Bonk and Cummings implemented the universities first on-line course in educational psychology. Course evaluation and subsequent refinement occurred shortly thereafter Bonk & Dennon (1999) and the course framework was considered strong enough for associate instructors to implement.

This paper focuses on the experiences of two associate instructors who taught this web-based course in educational psychology, while simultaneously taking a course in Teaching and Instruction, and consulting with the course designers. While great latitude was given in teaching the course, it was accompanied with the need to justify any revisions. For the most part, each instructor maintained the basic framework during his or her first semester the course was taught. Both associate instructors were graduate students in the Department of Counseling and Educational Psychology with prior teaching experience, although neither had experience teaching an on-line course.

Technical skills varied

The first step, according to Burger, was to organize an approach to teaching educational psychology on-line. This involved consideration of the material and the method. After reviewing several current texts, Burger chose Snowman and Biehler's Psychology Applied to Teaching - 9th ed. (2000). She chose this text because Dr. Bonk, one of the course designers, wrote portions of the text pertaining to the use of technology, and because the text and course materials, framework, case studies, and other activities were available and integrated, more time could be used to review course material; very helpful when teaching a new course. To maintain the structured feature of the course, Dakwa also selected the Snowman and Biehler text. The integration of technology into the textbook by Bonk (2000) made teaching with the text on-line very appropriate. Especially for first time on-line instructors.

Instructional Theory

As instructors, we realized that specific instructional approaches adopted could greatly influence student's interest in the classroom and consequently affect student learning of content. - Utilizing a research-based instructional approach, we proceeded to create our on-line classroom.

Instruction, according to Driscoll (1994), is to deliberately arrange learning conditions in such a way that specific goals can be attained. To assist in systematizing these learning conditions some instructional theories have been set out to provide a framework in which these learning conditions can be created. Reigeluth (1983) defines instructional theory as the identification of methods that best provide conditions under which learning goals are most likely to be attained. For the instruction to be successful, it must be compatible with the learning objectives (Reigeluth, 1983; Driscoll, 1994). In our on-line class, our syllabus was very detailed, stressing learning objectives, presenting assignments and all due dates (which were flexible), readings, and description of all course requirements. During the first physical meeting (it is highly recommended that instructors and students meet at the beginning of class if possible) these objectives were discussed in detail, greatly enhancing instructor/student interaction during the course.

Instructional theories encompass learning theories, in that it is the instructional methods adopted by the instructor that will determine the outcome of the learning theory adopted. Figure 1 shows that the core of the instructional process is outcome. Choosing the appropriate instructional theories leads to more effective use of learning theories, and provides a clear path for obtaining instructional objectives. It should also be noted that several other factors contribute to the learning outcome e.g. student motivation, whether class is an elective or requirement.

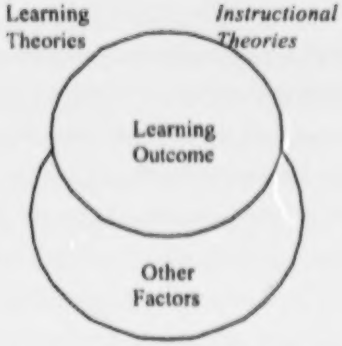

Fig. 1. Relationship between Instructional and Learning Theories and other factors influencing outcome

Particularly for emerging professionals, it is imperative to consider the difference between desired learning outcomes and actual learning outcomes (Reigeluth, 1983). Actual outcomes, Reigeluth writes, are "the real-life results of using specific methods under specific conditions, whereas desired outcomes are goals, which often influence what methods should be selected" (p. 15). This is a crucial point. It is at the beginning of designing the classroom framework that the instructor needs to invest a large amount of time selecting specific methods to be used for the desired learning outcomes.

The Web has created vast opportunities for educators and students, researchers, and practitioners. According to the US Dept of Education 2000 report, 84% of two-and-four year colleges expect to offer distance-learning courses on the web in 2002. Clearly, the earlier work of web educators and student response will be extremely valuable in the coming years. While the basic framework for the on-line course in educational psychology remained stable, the design for the chosen software (SiteScape Forum), as well as the strategies chosen to present the material and specific content for the course, continues to evolve. The growth of teaching on the web continues to expand and it is imperative to be aware of the various pedagogical strategies being developed for on-line teaching; strategies that have been used to harness the current technological advancement and provide efficient, effective, and creative opportunities in education and training.

Duffy and Jonassen (1992) noted that objective perspectives have for some time shaped instructional design practice. They suggested that constructivism provides an alternative basis for conceptualizing instructional experiences. In designing an effective and efficient distributed learning interface, the following seven criteria should be considered: extensive interaction; flexible structure; multiple resources; transparent interface; learner control; attention; and satisfaction. In addition, one might note that the on-line format for this educational psychology course also enhances student information processing ability, strengthens approach to novel tasks, and extends the classroom beyond the four walls by incorporating rich resources from the world wide web and other non-traditional methods.

When teaching in a medium that does not support any physical interaction with students, instructors should structure content so that ideas are related and attention is given to the sequencing of information flow (Reigeluth & Stein, 1983) with special consideration for: selections, sequencing, synthesizing, and summarizing (the four S's). Structure and clarity is always important in an on-line environment, but particularly so when students are experiencing an on-line course for the first time. Reigeluth & Stein's (1983) Elaboration Theory of Instruction suggests that instructors first present an epitome, or an instructional block of information, to the students, along with a motivational strategy. This would then be followed by a level-1 lesson, elaborating on various aspects of the epitome. This elaboration serves to help the student organize the content of the epitome. Finally, detailed content, reaching the objectives of the lesson is presented. By systematically presenting the content and summarizing as the lesson is presented, students are able to assimilate and accommodate the content as the lesson proceeds.

The ARCS model of motivational design integrates a wide range of theoretical perspectives including (but not limited to) social learning theory, decision theories, locus of control, and attribution theory. In addition, this theory for instructional design acknowledges environmental and humanistic views, as well as cognitive dissonance and learned helplessness. The acronym ARCS stands for Attention, Relevance, Confidence, and Satisfaction; all-important aspects of motivation. The on-line environment presents particular challenges for instructors when considering issues of motivation. To begin, students tend to perform better in on-line classes if they have developed a degree of self-motivation and self-regulation. It is much too easy to put off course requirements for an on-line course. Students quickly learn, however, that is also quite difficult to get caught up. During the orientation sessions and especially the first two weeks of a web course, an instructor must remain very sensitive to indications that a student is struggling with issues of self-discipline. Early involvement and interesting activities help significantly. Having a choice in the activities and projects also increases motivation and helps the student become invested in their own learning.

The On-Line Experience

To begin, the first semester, Dr. Bonk (course designer) and Burger (associate instructor) co-presented the student orientation for in-resident students. Dr. Bonk led the general orientation and then each section of the course adjourned to separate computer labs for the individual section orientation sessions. General orientation addressed the field practicum component of the course, while section orientation in the computer labs provided the opportunity for students to become acquainted with each other and course issues such as: course design, requirements, methods for evaluation, the syllabus, and technological issues. A written version of the orientation was posted on-line for distance education students (and for review for the in-resident students, as needed). Students spent a portion of the orientation sessions navigating the web site to ensure they understood the forum layout and how to post responses or modify them.

The following semester, Burger and Dakwa, the associate instructors, co-presented the course orientation in the same general manner. Support from Dr. Bonk was obtained weekly during a continuation of the course in Teaching and Instruction, in addition to individual consultation. This course provided opportunities for associate instructors to explore theoretical as well as practical issues of teaching and learning, and provided the opportunity to raise particular issues or problems in a supportive and collaborative environment.

A constructivist approach to teaching and learning was evident both in the graduate course for the associate instructors, and in the method used to scaffold the instructors into the profession of teaching Simms and Ponder (1997). Further, the approach is evident in the associate instructors' on-line classrooms, embodied in their instructional approach to facilitate learning of the undergraduate students enrolled in the on-line course. So often, a new task can seem overwhelming. However, knowledgeable use of Vygotsky's Zone of Proximal Development (ZPD) with students at any level in their development greatly lessens any sense of bewilderment. Mentoring and apprenticeship were very effective tools enabling an associate instructor to grow gracefully into the profession. We made it a point to have a one-on-one meeting with each student mid-way through the course to obtain student insight and assist with any difficulties the students might be encountering.

The starting point of having a framework from which to teach undergraduate educational psychology was very helpful. The course evolved from a framework that included an interactive textbook, a syllabus, case studies, activities, and an on-line forum to serve as a point of contact between students and the associate instructors. The forum held the course syllabus, course calendar, reading schedule, discussion groups, and places to post the student work, as well as grading criteria and student grades. There were never any questions about what assignments had been received, when they were due, or how many points the student's had earned for their work, as this information was available via the on-line forum.

The opening screen for the SiteScape Forum was rather simple, offering students choices such as: Discussion, Weekly Work, Journal, Projects, or Café. From there, if students selected Discussion, they would then choose Discussion Week 1, Discussion Week 2, etc. The Café held lists of which students were responsible to facilitate each discussion. During the orientation session, students signed up to co-facilitate two weekly discussions. The Café also held "extra's" such as votes taken on classroom issues, current events pertaining to course material, and so on. Designed in this way, navigation was very straight forward, with the majority of students leaving the orientation sessions with complete confidence in their ability to operate in an on-line environment. The course structure encouraged students to contribute frequently and the tasks and activities were clearly specified. Occasionally students asked questions by email, which was usually heaviest at the beginning of the term. Email communication was also used if students had sensitive material to discuss and did not wish to post particular material on-line for the rest of the class to view.

The classroom environment was easily established and a team spirit was recognizable as we worked together to solve functional difficulties that occurred from time-to-time. Not being a technological genius has advantages! The students rallied and we worked together to solve problems such as those occurred when 25 people, of varying experience or skill level, attempt to work together on-line.

Together, as a class, we adjusted when the publisher's website (containing optional weekly activities) experienced technical difficulties and went off-line. We adjusted due dates as needed to recognize the flexibility so desirable in on-line courses. We examined the impact of due dates and late work both from a teacher's and a student's perspective. Together we explored issues of assessment and evaluation, and all benefited from sharing each other's views enabled by the open, authentic learning environment. Pre-service teachers gained experience by co-facilitating weekly assignments during the on-line class. They created optional weekly activities for the other students. Case studies, in addition to field experiences, provided authentic scenarios for student reflection. Other student's of Dr. Bonk had written many of these case studies previously. Mistakes made were turned into "teachable moments" and every opportunity to discuss educational psychology in terms of the learning we were accomplishing because of our particular course design greatly added to the content of the textbook, journal articles, and field experiences in elementary or secondary classrooms. Duffy & Cunningham, (1996) assert that "learning becomes a matter of change in relation to the culture(s) to which one is connected – with the gradual transformation of one's means of constructing one's world as a function of the change in membership in that culture". Culture in this sense is broad. The culture in which the learner finds him- or herself will determine the kinds of knowledge creation that will occur. We hope that a culture of collaboration and willingness to explore divergent theories in a safe environment will be incorporated and passed on because of experiences such as these.

Open journals pertaining to the student's field experiences illuminated both fears and hopeful expectations regarding first experiences, as novice teachers, in the classroom. Students shared their views in the open journals, and emailed one another. An interesting activity that was used as an icebreaker during orientation, involved students writing one of their fears when entering their classroom for the first time. Responses included "being boring," "not knowing the material," and "the kids won't like me." At the end of the course, when we met to view student presentations, the cards were brought back out and discussed. Most students agreed that they enjoyed hearing about the other students' fears, and were greatly relieved when most of their fears did not actualize. While distance education students did not attend the orientation, or closing meetings, transcripts of the events were posted for their review.

Finally, one insight gained from this experience, is that it is most important to "catch" students before they fail. Sometimes the technological demands are too confusing for beginning students. I lost one student the first semester, as I didn't realize the extent of her difficulties until she was hopelessly behind. To remediate this, I instituted a "mid-term check-up" in which I met individually with each student. We discussed their general progress, problems and insights, plans for their class project, etc, and this became a strategy I will use whether teaching on-line or in a traditional classroom.

Using the American Psychological Association's Learner Centered Principles and a socio-cultural constructivist approach to on-line teaching provides the opportunity for students, at any level, to recognize "the legitimacy and limits of the vast array of approaches" (McCaslin & Hickey, 2001) to teaching and learning educational psychology. Further, a structured framework such as that provided by Bonk and Cummings (1998) provides excellent scaffolding to support an associate instructor's emerging skills when teaching undergraduates in an on-line environment. As the undergraduates integrate knowledge of the content of educational psychology, in the context of an on-line environment, the elementary and secondary students they teach will receive the benefits of an expanded approach to traditional teaching. In this constructivist environment, cognitive flexibility is enhanced.

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With the best of intentions: First semester experiences using BlackBoard

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Abstract

In an attempt to provide a central repository of online services, offer services not currently being provided and, through some form of distance education, increase enrollment and therefore revenue, a small northern New York college investigates, recommends policy for, and implements an online course management system. This paper details our procedures, challenges, and experiences with the implementation of BlackBoard 5.0. Recommendations are made to help similar institutions avoid some of the mistakes we made when considering use of such a system. We advocate a systematic reasoned approach to implementation.

Introduction

This is a case study. It is a story about the planning decisions and implementation strategies for a course management software package in a small northern New York College. The planning phases and first semester that the course management software was put online is under consideration in this study. One of the researchers was hired in part because his main suit was distance education and is of a unique perspective to look at the college's first semester experiences as it related to the last two or more decades of research in to distance learning. The data collected, outside of being interesting from a narrative perspective, serves as a cautionary tale for institutions of approximately our size (between 4000 and 5000 students). It shows-with the best intentions of everyone involved-how a school unversed in the constructs and constraints of distance delivery both succeeded and failed during its first semester using course management software, in our case BlackBoard 5.0

Planning and Acquisition

Although the reason for bringing BlackBoard into our school was not clarified to the faculty in specific terms, there was a general sense of the needs of the faculty as demonstrated by their piecemeal efforts at adding electronic components to their courses. Some of these efforts included placing course syllabi on the web, communication among students in a discussion forum, and transferring files between students and faculty. Prior to BlackBoard, each of these services was available and supported separately. Online syllabi were created by the faculty member, and placed in her personal web space. Discussion forums were handled via newsgroups, which could be made available off campus but were this mean that anyone, not just the students in the class, could use them. File transfer was handled primarily via e-mail attachments for off-campus users, while on campus each instructor could create a shared space where files could be made available to students as well as space where students could submit their files to the instructor. One of the pushes for course management software was that there was a general notion that it could do all of these things and more, in an integrated package. Specifics of what "more" constituted was not clearly explicated or fully questioned. Also not fully questioned was how various features were implemented.

The College had a mission of increasing its reach to geographically diverse locations outside of the traditional mix of mostly in-state students. Along with augmenting the instruction given to our current students, there was a sense that this would "open the door" to future inroads in delivering distance education courses. This in turn would mean increased enrollment and ultimately increased revenue. Finally, there was a sense that other institutions were using course management software, and that if we did not adopt something, we would be "left behind."

Among the various competing course management options, the college saw BlackBoard as a solution that addressed both the demonstrated faculty needs and future distance education possibilities. Under consideration were FirstClass, TopClass, and WebCT. FirstClass was seen as not containing enough features such as an online grade book. TopClass had been tried previously in a small test, ending in disastrous results. WebCT was considered to have a higher learning curve than BlackBoard. BlackBoard was marketed as being the most stable, having the best feature set, and having the easiest learning curve of the competition. Price was also considered, and the most basic level of BlackBoard, level one, was quite inexpensive when compared to the other course management systems. A one-year license allowing us to put every student and faculty member on BlackBoard cost a mere $5000. As an institution progressed up the levels, the price increased dramatically, but that was not a concern for initial implementation. BlackBoard 5.0 was purchased in the summer of 2000. Unfortunately the BlackBoard approved server, did not arrive until November of 2000, too late for implementation in the Fall 2000 semester.

Implementation

Having been promised BlackBoard for the fall, an incoming faculty member, acting on the advice of representatives of BlackBoard, decided to put a number of courses on the BlackBoard.com site. BlackBoard allows anyone to put courses on their website to demonstrate the capabilities of their system as well as to act as a marketing tool. This became problematic for a number of reasons. Blackboard has enjoyed quick growth, however that growth has created increased Internet traffic, which puts quite a strain on its server, creating a situation of poor connectivity. Attempting to access a course on the website during hours when both the east and west coast were logging on often resulted in not being able to connect at all. If a class was dependent on BlackBoard.com, it was soon found that the class would have to make other arrangements. This was both totally unacceptable and created a bad example for both students and faculty. When connectivity could be achieved, the limited feature set of the site, which we later found out was utilizing BlackBoard level 2, and no technical support increased the problem. At the end of the semester BlackBoard, who had previously agreed to archive these courses for transferal to our local server, would not, the faculty member was told by our instructional support person, respond to repeated phone calls.

BlackBoard 5.0, freshly installed on our Dell server, was rolled out for the Spring 2001 semester. At first the Blackboard server was not meant to provide distance learning in a traditional sense, rather it was put in place to enhance the classroom experience (Dede, 1997). The initial meetings of the BlackBoard advisory committee thought it wise to allow a low number (no more than five) of instructors use the system in the first semester. This recommendation was made since it was clear to the majority of the committee that the first semester was to be considered a beta test, where any kinks or bugs typical with implementing new software would be experienced by a small number of faculty. These faculty members would then in turn be responsible for reporting the problems to be fixed before the following semester, when BlackBoard would be made available to a larger group faculty.

There were two persons put in charge of the BlackBoard initiative. One person was intended to provide instructional support to the professors interested in using BlackBoard; the other would be in charge of maintaining the BlackBoard server. Unfortunately, the instructional support person did not share the same vision as the advisory board. BlackBoard was offered by the instructional support person, to all of the roughly 250 full-time faculty members as something to try if they so desired. This ecumenical concept was contradictory to the advisory committee who had warned that the first semester should be devoted to debugging the system. Forty-nine faculty members decided to use BlackBoard in some capacity for their courses.

BlackBoard was 'sold' to the faculty as a seeming panacea, where courses could easily be put online, and there would be sufficient support for those that decided to take the plunge. As it turned out, people using more than a smattering of BlackBoard spent many hours revamping their courses and a good deal more time than many expected in course maintenance (Palloff & Pratt, 1999). The instructional support, unfortunately, was not sufficient to meet this demand, a situation quite common in such situations (Berge, 1995; Ellsworth, 1995; Green, 1998). The instructional person did not know enough about the BlackBoard environment to adequately support the large number of faculty using the system. This person had no formal training other than being given the manual and being sent to a BlackBoard Conference. In a real sense training was situational and 'on the job'. What was expected to be instructional support became technical support since the support person's time was spent training faculty and dealing with situational problems. On top of that, the server support person was not ready to support demand created by the immediate presence of forty-nine faculty members and over 1000 BlackBoard users. During the first few weeks the server froze if more than a handful of people tried to access the same information at the same time. This became more of a problem since all graduate courses start at 5:30pm and technical support ends their day at 4:00pm, so if the system became unusable, help was not provided until the next day leaving any number of classes floundering. There was no training for students provided by anyone other than faculty who were less than comfortable with using BlackBoard themselves.

As the semester wore on, frustration grew as the instructors who were sold on this 'wave of the future' became frustrated with technical fixes that never came fast enough. To add to this, they also began to rethink why they were using BlackBoard in the first place, as the answer to this salient question was not apparent. Some instructors (Winograd, 2000) became angry over the situation and decided to ditch BlackBoard altogether, some stuck with it, and had good success with it. The majority of those experiencing success were early adopters of technology, had a basic sense of what to expect through experience with either BlackBoard or another course management system, or started small, using one or two features and building from small victories.

Recommendations

It is our hope that our experiences may well help other institutions of our size understand the pushes, pulls, and personality aspects of the implementation of a course management system. Careful consideration should be given to 'jumping on the bandwagon.' Looking at this from a critical perspective is invaluable to prevent institutions from becoming cattle following the herd (Winograd, 2000).

> It is critical, absolutely vital, that the demonstration projects be of the highest possible standard, since failure or mediocre results will have exactly the opposite effect from what is desired. For this reason it is imperative that financial, technological, and human resources be ruthlessly focused (Moore & Kearsley, 1996).

To this end, we would like to give some basic recommendations to those about to go through what we did:

1. Start with a Needs Assessment.
2. While many of our needs were self-evident, they were not always fleshed out. Many assumptions were made about what faculty wanted and what the course management software could deliver. Some turned out to be accurate, although many turned out to be incomplete or inaccurate. Some of the salient questions we never asked directly included:
   - Do we really need a course management system?
   - What were our goals and objectives?
   - What were some experiences from other institutions faced with the same issues?
3. A needs assessment would not only help us to answer these questions, it also would help us to raise questions that were not necessarily self-evident.
4. Have a timeline for partial and full implementation with significant stages identified. It is critical that the partial implementation phase be used as a test phase for working out the many bugs, both from a technical support and instructional support standpoint. By building from small successes, and learning from problems, the pilot stage can lead to a successful full implementation phase.
5. Have sufficient, qualified technical and instructional support personnel. This is absolutely critical, yet, in reality, perhaps the hardest to assure given the limited human resources of many campuses. It would help if these personnel were acquired via a search, rather than via administrative appointment.
6. Make sure you have strong administrative support, and that the decision making process is a shared decision, not in the hands of a few individuals.

Conclusion

In conclusion, it could have been better, and it could have been worse. We asked many of the right questions, and had in many regards a well-considered approach. Our failure was that although many useful recommendations were made, very few of them were followed. A reasoned approach is far more helpful than jumping in and seeing what happens. In hindsight, it was a lack of coordination and consistency in the process that led to the majority of our problems. It gives us hope that others may benefit by learning from our experiences.

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Action Research on Building Learning Communities in Cyberspace

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Abstract

The paper reports action research on web-based courses conducted from 1999 to 2001. The goal of the research was to investigate students' opinions toward such courses and to examine the impact of using different strategies on online communities. Data collection relied on online discussion messages, observations, interviews, and surveys. Both quantitative and qualitative methods were utilized in this study. The results revealed that students and the instructor were in favor of web-based courses and that the use of moderating strategies greatly influenced online communities.

Introduction

"How many online (web-based) courses does your program offer?" "How often do I have to come to campus for my course work?" Such questions are now being asked much more frequent than ever before, and answers to such questions have become factors for learners to select their institutions and for institutions to attract their students. This fact is changing our society and shifting our educational paradigm. In response to the paradigm shift, many educators offer web-based courses. Some educators have high regards for such courses because they offer opportunities to people who cannot receive education otherwise due to large distance between home and school. Some view it as an alternative that provides learners with options of learning. Some even expect virtual classrooms to be the future of education. Meanwhile, other professionals doubt the value of such education and question its quality. Do students favor such courses? What are benefits and barriers of such a delivery format? How can we make such courses effective? To answer these questions, more research on this topic is needed.

"Online courses," "completely online courses," "web-based courses," "web supplement courses," "hybrid courses," and some other terminology are used by professionals. Some educators consider courses containing online features like synchronous or asynchronous communication to be online courses. According to this definition, courses in which instructors use these features but still meet students on a regular basis would be considered to be online courses. However, other educators disagree and only view courses in which instructors meet students half or less than half of the regular scheduled meeting time during a semester (quarter) to be online courses. Further, even other professionals only recognize courses in which instructors and students do not meet at all to be online courses. To avoid confusion, the author uses the expression "hybrid courses" in this article to refer to the courses in which an instructor and students meet half or less than half of the regular scheduled meeting time, and such courses are the courses involved in this research.

In this article, the author first introduces background that illustrates why the author conducted the research. She then describes her hybrid courses and strategies used in these courses in order to help readers understand the structures of the courses. After that, she reports the action research including data collection, data analysis, and results. Discussions and recommendations are also provided in this article.

Background

The author is associate professor of Instructional Technology at a state university in the United States of America. The majority of students in her study was in-service teachers and worked full time. They sometimes could not attend classes because of their responsibilities at schools, for examples, open house day, parents day, coach seasons, or because of their obligations to their families. When they came to class, they often were exhausted and hungry because they just rushed to the class straight from their schools, where they had been working for at least eight hours. They sometimes had to call home to check if their children were fine or had to leave classes early because nobody was taking care of his/her family. Observing all the demands that the students encountered, the author realized that these students were different from the students whom she had taught before. The ones she was teaching were reentry students or adult learners while the ones she had taught before were traditional full-time students. She wondered if a traditional classroom provided her reentry students with good learning conditions and if another educational delivery format would work better for them.

While she was pondering this issue, she received one of her university grant proposal calls, and this grant was designed to support faculty to convert traditional courses to online or hybrid courses. She applied for the grant with the intention to examine if such a delivery format would benefit her students. She received the grant in the spring of 1999, converted a graduate course to a hybrid course during the summer, and implemented it during the fall quarter of 1999. She received positive feedback from her students and continued teaching two additional hybrid graduate courses during 1999-2000. All these three courses were offered at two campuses and offered again during 2000-2001. During these two years, she collected data from her students and conducted research on online instruction. Her hybrid courses and the research are described below.

Instructional Design and the Hybrid Courses

As Grabowski (2001) stated, instructional design is closely connected to the beliefs of the course designer. Some instructors structure an online course as an independent study, and students receive credits as long as they complete course assignments. Accordingly, students could obtain credits at any time during the semester and have no interaction with other students of the course. On the other hand, some educators design an online course in a way that students have to participate in ample interactive activities with others, such as their classmates. Instructors using the former structure might view independent study, one of the four aspects of distance learning (Keegan, 1993), as an important aspect while educators using the latter one might consider interaction and communication to be essential.

The author of this article supported the latter when she designed her courses. She believed that social interaction plays an important role in learning (Vygotsky, 1978) and valued active learning and meaningful learning (Grabe & Grabe, 2001; Brown, 1992; Knapp & Glenn, 1996; Means et al., 1993). Agreeing with Palloff and Pratt (1999), she regarded an online community as crucial in a hybrid course and designed her courses in a way that her students had to interact with other students to enhance learning. Like Oliva (2000) and Santema & Genang (2000), she encouraged students' active learning and invited students to construct course materials together with her. She met her students four times throughout the quarter—at the beginning, in the middle, and at the end. All assignment submissions and discussions were conducted online via WebCT. She constructed a variety of forums (discussion boards) for students to communicate with each other and to share resources, for example, forums for making announcements, for asking questions and receiving help concerning technical issues, for submitting assignments, and for providing feedback and critiques to their classmates. In all her courses, students had to post their assignments to the forums, review assignments of their classmates, and critique each other's assignments. These activities provided students with basic channels for communication.

	1999-2000 (without moderating)	2000-2001 (with moderating)
F	Synchronous (Instructor posting topics)	Asynchronous (Medium-duty moderating)
W	Asynchronous (Student posting topics)	Asynchronous (Heavy-duty moderating)
S	Asynchronous	Asynchronous (Light-duty moderating)

Table 1. Different strategies used in the hybrid courses. F = Fall quarter, W = Winter quarter, S = Spring quarter

In addition to using assignments to enhance interaction, the instructor also employed different strategies to facilitate students' communication. Table 1 above shows strategies used in her hybrid courses. She used moderating strategies during the second year (2000-2001) while she did not use them during the first year (1999-2000). During the fall quarter of 1999, all students conducted synchronous communication every week and discussed topics that were posted by the instructor. During the winter quarter of 1999, students used forums to conduct threaded discussion about topics generated by their classmates. During both quarters, students obtained participation points based on frequency and quality of their posted messages. They were aware that they had to post at least two messages every week to receive participation credits. Such participation requirements were not expected during the spring quarter of 1999.

During the second year, the instructor used moderating strategies in the three hybrid courses in which students took turns to moderate their online community for a week. It was understood that the instructor would not jump in to answer questions unless it was necessary and that the students would receive credits based on how well they moderated the community. For example, if a question or a problem on a discussion board remained unanswered or not acted upon, the moderators of the week would be marked down. Moderators did not have to answer all questions or solve problems but they needed to facilitate discussions about the issues within the community.

Based on responsibilities and tasks the students conducted, the moderating strategies varied. The instructor categorized them into three types of moderating: medium-duty, heavy-duty, and light-duty. During the fall quarter while the medium-duty moderating was conducted, moderators posted discussion topics, hosted online discussions, and answered questions posted by their classmates. During the winter quarter while the heavy-duty moderating was conducted, moderators not only took on the same responsibilities as in the previous quarter but also assigned readings, generated rubrics, and further evaluated their classmates' online performance. During the spring quarter while the light-duty moderating was conducted, moderators only needed to host online discussion and answer questions posted by their classmates.

The Research Study

The goals of the research were to investigate students' opinions toward hybrid courses and to examine the impact of using different strategies on online communities.

Subjects

The participants of the study were the students in the twelve hybrid courses during 1999-2001. They were in-service teachers who were pursuing their Master's degree in Instructional Technology at the university and had little experience with hybrid courses.

Methodology

At the beginning of each course, the instructor explained to the students the course and their responsibilities, especially their duties related to the different strategies used in an online community. During the courses, the instructor posted questions for discussion. Examples of questions included (1) What are benefits and barriers of hybrid courses? (2) What are advantages and disadvantages of conducting synchronous and asynchronous communication in hybrid courses? (3) Do you like the moderating strategies used in this course? and so forth. During the last meeting of each course, students filled in a survey that contained 10 Likert scale (1-4) questions and open-ended questions. The Likert scale questions were guided to examine the following points: (1) Compared to a traditional class, did students feel that they learned as much as, or even more, in the hybrid course? (2) Compared to a traditional class, did students feel that they spent as much as, or even more, time preparing for the class? (3) Compared to a traditional class, did students feel that they were motivated as much as, or even more, to learn in this course? (4) While taking the course, did students have sufficient access to the instructor? (5) While taking the course, did students have sufficient interaction with other students in this course? (6) Given the choice between traditional courses and hybrid courses, did students prefer a hybrid course if the course content were suitable for a hybrid course? (7) Did students wish that more hybrid courses were offered in the Masters program at the university? (8) Would students enjoy taking another hybrid course? (9) Were students concerned about the quality of hybrid courses? (10) Did students like the delivery format? (11) How many sessions in which the teacher and the students meet would be appropriate for a hybrid course? Open-ended questions of the first year focused on benefits and barriers of hybrid courses while those of the second year emphasized the impact of moderating on online communities.

In addition to online messages and surveys, data was also collected from observations and interviews. The author observed students and activities online as well as during class meetings. Interviews were informal and occurred when there was a need for clarifying students' comments.

The author tabulated the survey data. She also downloaded students' messages related to the research, color-coded messages, and categorized them into appropriate folders based on the topics, for example, benefits of web-based courses and barrier of web-based courses.

Results and Discussions

The table below reports students' opinions toward the hybrid courses offered from 1999 to 2000. As mentioned above, the first course was funded by an internal grant and was used as a pilot to examine if the students preferred a hybrid course to a traditional one. The survey used in the first course was modified and improved for the upcoming quarters, which explains why some numbers in the table are missing.

First Year	Pilot (F)	2nd (W)	3rd (S)
Learn more	2.13	3.08	3.46
Spent more time	1.75	3.51	3.58
More motivated		3.30	3.52
Access to instructor	2.25	3.58	3.39
Interaction with students		3.06	3.22
Prefer a WB course	3.38	3.40	3.68
Wish for more WB courses in program	2.88	3.40	3.55
Enjoy taking another WB course	2.75	3.58	3.55
Concerned about quality of WB course		2.05	1.64
Like the delivery method	3.31	3.20	3.52

.F = Fall quarter, W = Winter quarter, S = Spring quarter

Table 2: Students' responses during 1999-2000. WB = Web-Based (hybrid) course

The results indicated that students were in favor of a hybrid course. The students felt that they learned as much as or even more in such course and that they were more motivated. They wished that more hybrid courses would be offered in the academic program, and they preferred a hybrid course to a traditional course.

Most of the means on table 2 went up when time progressed. The instructor felt that this fact was partially due to the experiences she and her students gained from the hybrid courses. She also felt that certain characteristics were necessary for people to succeed in such courses, for example, being self-disciplined. Since the students and the instructor did not meet every week, students had to be self-disciplined and be able to complete tasks without much supervision. More than half of the students revealed in their surveys and interviews that online learners should be self-disciplined and complete tasks on time. Four students who received incomplete during the first quarter pointed out a need of such characteristic. One of them said, "I have difficulty in the online [hybrid] course because I'm not so disciplined and often postpone my work. In a traditional course, I would be reminded every week when I go to class. But this is not the case for taking an online [hybrid] course. "

Although people who tend to delay their work might have difficulty surviving in hybrid or online courses, the instructor believed that preparing students' mindset before they took such courses could be helpful. Therefore during the first meeting of her courses, she always asked students who had taken her hybrid course(s) before to share with other students tips of being online learners. "Don't postpone your work" was mentioned repeatedly by the students.

As mentioned earlier, students conducted synchronous communication in the first course and asynchronous communication in the second course. In both courses, students received participation credits. In the third class, asynchronous communication was utilized but no participation credit was issued. The different strategies used in these three classes had an impact on the online communities. The research results indicated that synchronous communication strengthened students' sense of belonging. A student stated, "Although we do not see each other every week, the real-time communication makes me feel we belong to the same class." Such a sense of belonging was less common when asynchronous communication was used during the second quarter. During that quarter, a few students addressed that they missed real-time communication and requested the instructor to sometimes conduct such communication while they were enjoying the flexibility that asynchronous communication provided. Observing the three courses, the instructor found that the online community of the third course seemed to be loose and thought that issuing no participation credits might have contributed to the loose community. The instructor suggests online instructors employ asynchronous communication and synchronous communication alternatively and use participation credits to motivate students participating in online communities.

Students listed several benefits of a hybrid course: flexible schedule, being able to work at any time and at any place, and being able to choose the best conditions for learning. They also mentioned that hybrid courses saved them gas and time on commuting and allowed them more access to instructor and to their fellow classmates.

Barriers also existed in a hybrid course. The participants missed face-to-face communication and personal contact. Students with low technology skills felt pressured and anxious. Such pressure and anxiety might create a negative impact on learning. Despite these barriers, students expressed that they would still choose a hybrid course over a traditional one if they had an option.

Like the students, the instructor enjoyed the flexibility hybrid courses provided and missed face-to-face contact with her students. Unlike the students, she experienced tremendous pressure of responding to students' messages and of their expectations of receiving responses instantly. Meeting students once a week in a traditional course became meeting students 24 hours a day, seven days a week online. In addition, it was time consuming and stressful to communicate with a couple of students who often got confused and repeatedly asked the same questions no matter how clear information was, for example, on when an assignment was due and when the next meeting would be. Such stress was eased during the second year when moderating was used in her courses.

During 2000-2001, the instructor utilized medium-duty moderating in the first (Fall) quarter, heavy-duty moderating in the second (Winter), and light-duty moderating in the third (Spring) quarter. As mentioned earlier, the differences among the three types of moderating were based on responsibilities and tasks students conducted in the hybrid courses. Data collected from survey open-ended questions, online discussions, observations, and interviews indicated that both the students and the instructor favored the use of moderating in the courses. The students felt sense of ownership of their online communities and learned from their peers by observing how their peers hosted the communities. They received answers much faster than before because every member of the communities tried to help answer questions. The instructor also favored the moderating. She noticed that she was less stressed responding to students compared to the first year and that the students received responses faster and became very active in the online communities. The communities became very dynamic, and she felt the courses sometimes could smoothly move forward like a car with a "cruise control".

Second Year	1st (F)	2nd (W)	3rd (S)
Learn more	3.73	3.15	3.46
Spent more time	3.90	3.93	3.73
More motivated	3.80	3.33	3.56
Access to instructor	3.83	3.62	3.43
Interaction with students	3.50	3.45	3.46
Prefer a WB course	3.81	3.42	3.73
Wish for more WB courses in program	3.85	3.63	3.63
Enjoy taking another WB course	3.72	3.66	3.70
WB providing better quality	3.70	3.45	3.70
Like the delivery method	3.70	3.27	3.66

F = Fall quarter, W = Winter quarter, S = Spring quarter

Table 3: Students' responses during 2000-2001. WB = Web-Based (hybrid) course.

Among the three different moderating strategies, the students favored the medium-duty moderating the most and the heavy-duty moderating the least. During the winter (heavy-duty) quarter, the responsibilities of the students and their activities appeared too complicated. Moderators of every week tried to do a good job by assigning readings, setting objectives for the week, and facilitating discussion; often their readings and objectives were too many to be accomplished within a week. Students conducted many different activities when time moved on. At the end, they were distracted by the objectives of different moderators and forgot the objectives of the course. In addition, moderators often had to participate in activities of a week while they were still evaluating their peers' online performance of the week when they were the moderators. This was indeed a hectic quarter, and the instructor learned a big lesson from the experience. Appropriate amount of online communication could enhance learning while too much communication might cause learners to withdraw from the community (Palloff and Pratt, 1999). Students' dislike of such moderating is clearly revealed in the table above. A number of the means during the winter quarter dropped and consistently appeared to be the lowest among the three courses. Students spent a lot of time (mean=3.93) on the course but did not necessarily learn more (mean=3.15). They liked the course the least (mean=3.27) compared to the other two courses of the year.

Although the Winter quarter was hectic, students still favored hybrid courses. Issues addressed during the first year, like benefits of such courses and their wish to have more hybrid courses in the program, repeatedly appeared in the second year. Students also liked the fact that they had to post their assignments and review their peers' work. By doing so, they learned much from their peers. They liked meeting three to four times per quarter and did not seem to favor an online course without a face-to-face meeting.

A hybrid course did provide flexibility and convenience to learners, especially to learners at remote areas. While hybrid courses are blooming in many places, the author thinks that hybrid courses should not (1) be independent studies in which no interaction among students are necessary, (2) be only task-oriented in which social learning is neglected, and (3) lower the quality of education. Instead, the courses should be structured to raise the quality of education because learners have (1) options to choose their best learning conditions and (2) opportunities to enhance their learning using resources beyond boundaries of time and space.

Conclusion

The paper reports action research on online courses conducted from 1999 to 2001. Data were collected from three courses (12 course sections) at two campuses during the two years. Data collection replied on online discussions, observations, interviews and surveys. Both qualitative and quantitative research methods were used in this study.

The results indicated that students and the instructor were in favor of hybrid courses and that the use of different strategies had an impact on online communities. Using synchronous communication and asynchronous communication alternatively could enrich online communities, and moderating strategies with careful design and organization worked well in hybrid courses.

Instructors should employ a variety of strategies to build up and nurture an online community that may lead to a success of hybrid courses. This new delivery method provides students with options of choosing their best learning conditions and with opportunities to enhance their learning using resources beyond boundaries of time and space. One can see its potential and positive impact on our education and society.

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Building online Executive Education courses that work: Design opportunities and challenges

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Abstract

How can instructional designers create executive education, seminar style (non-credit) courses that are short (one-two hours) but still provide a meaningful learning experience for managers and executives in an organization? Engaging and motivating learners in short courses without traditional assessment formats or external motivators such as grades or academic credit is hard to do and presents a challenge for designers who have "grown up" developing academic courses or professional training for traditional programs. This paper presents several design solutions that have been successful in this context. Unique instructional features, specific instructional design challenges, and a program of ongoing research are also described.

Introduction

Executive education courses are used to teach managers and executives the skills they need to succeed in corporate leadership. The audience for these courses is typically the managers across a company or business unit within a corporation. Common topics include leadership and management styles, strategies, and tactics, motivating employees, project management, business strategy, and many others. Executive education courses differ from traditional business academic courses in that they are generally shorter, and do not offer academic credit for successful completion. We have created many executive education courses in our role as instructional designers for UNext, Inc. and Option Six, Inc. This paper describes two of the most successful course models we have developed and implemented. We will explain the pedagogical approaches we have used, describe relevant course features, discuss the instructional design challenges we have encountered, and briefly explain our ongoing research agenda.

Executive Education

In the past, it was all too common for a company to promote an employee to a management position without providing any training or education targeted at the new roles and responsibilities of this new position. The new manager was expected to transfer their proven "line" expertise into the realm of management without retraining. Unfortunately this approach does not work well for many new managers. They are suddenly expected to understand cross-functional business concepts such as those in managerial and financial accounting, marketing, sales, and managing people. Training and expertise in one area of a business as a line worker (e.g. as a sales associate, marketing analyst, or manufacturing supervisor) does not necessarily provide the ability to excel or even function in the cross-functional world of management.

It is important for managers to be able to understand the basic concepts and language used in the other areas of their company. Why is it important to work within the information technology constraints dictated by the network manager? Why is it important to use the "company colors" on all new products? How do the operations of a certain business unit affect the corporate financial statements? Why is this important to the health of the company? These are questions that executive education courses are designed to help new managers and executives answer for themselves. They don't need a thorough conceptual understanding of accounting systems or network security measures, such as they might receive in a certification or academic MBA course, and a one to two hour course or suite of courses is often sufficient.

Executive education courses have often been delivered in traditional training environments, such as corporate training classrooms or off-site seminar rooms. The online courses we create are experienced in an anytime, anywhere format from the manager's networked computer, at work or home, whenever they have the time in their busy schedule. We have found most participants are able to devote an hour or two at a time to this kind of training. We attempt to keep each suite of courses short enough so that a new manager could finish the entire suite in one business day. In many situations, one dedicated "learning" day is more effective than trying to stretch the course out and keep participants motivated over several weeks. Occasionally, a business will have experience and resources to implement a synchronous online seminar setting, a "virtual classroom." If this is the case, we design courses that exploit this capability. It should be noted, however, that the instructional experience (information, learning, knowledge, etc.) in each course is designed to be completely accessible even if the synchronous component fails or is inaccessible to some participants. In fact, this is one of the design challenges we discuss later in this paper.

Instructional Approaches

We have developed and implemented two major models of instruction for executive education courses. While we have used other instructional approaches for specific training needs, we believe our two primary approaches fit most of the learning content and situations that we encounter. In each course model, we have implemented the learning values of experiential learning (learning by doing) (Dewey, 1897; others?). We believe that active learners are much more likely to learn than passive ones, so each course uses many interactive elements (cite interactivity in learning research).

Cognitive apprenticeship

The first model we used for executive education is based on the cognitive apprenticeship theory of learning. In this theory, founded primarily upon Vygotsky's notions of sociocultural learning and the zone of proximal development (ZPD), learning is accomplished by participants as they are guided through the study and experience of new information and skills by cognitive experts (Rogoff, 1990; Vygotsky, 1978). The expert begins with a large amount of control over the learning process and content, and gradually turns over more and more control of the learning to the learner. By the end of the experience, the learner is ready to perform the new skills or apply the new information on their own, in their own environment, as they begin to develop their own expertise through authentic practice.

In the training environments we create, the online course is the expert that guides the student through the learning experience. We structure the overall course experience and embed various course elements that support and guide the students' learning throughout. Beginning with a motivating and engaging lead-in to the content, we use predictable course segments that move from high "scaffolding" and gradually reduce the amount of scaffolding as the course progresses (Bruner, 1983; Rogoff, 1990; Stone, 1993; Vygotsky, 1978). In the end, the student is given tools and references to use on their own in their own work environment. Next, we'll briefly explain the course structure we've created. Please refer to figure 1 to see an example of this course structure from an actual course.

Each course is bundled with related courses in a course suite. Usually, there are four to five courses in one suite. Suites can be completed within one business day, in approximately eight to ten hours. In figure 1, the courses in the "Learn to Speak Accounting" suite are shown on the left side of the navigation frame (on the left). While there is no technical barrier to taking any course in any order, there is an implied order in the navigation system. In practice, it usually makes good "sense" to take the courses in their listed order, but we allow the learner the freedom to choose. Each course is further divided into common sections. Once again, the technical system does not require the student to follow the implied (physical) order as they work through the course, but the course content and connecting language used strongly suggest the implied order. These sections are listed in order on the right side of the navigation frame in figure 1.

Why Learn It

The first section of each course, the Why Learn It section, is designed to motivate the student's further study of the course content. Using a combination of text, images, vide, and multimedia, the overall importance of the content is explained. Often, we use a short case experience to engage the student, asking them to read or view a situation and make a few basic decisions. This experience is intended to show them that they may do not have all the answers or expertise (e.g. how to motivate different employees) they need, and that this course can help them develop their own expertise.

How It's Done

The second section of each course is the "How It's Done" section. He purpose of this section is primarily expository – explaining how a concept works in practice, how processes are carried out, or perhaps presenting a body of information that will be used in some subsequent practice or activity. The How It's Done section uses video segments, animations, text, and graphics to present information. A constant instructional practice is to include many relevant examples and cases of real companies and situations to maintain high student interest and increase the practicality of the instruction. Throughout this section, the course designer is still in control of the learning process for the most part. While no particular order is technically mandated, students generally read the text from start to finish, interacting with the course to watch videos and animations and read extra material in pop-up windows as they progress.

You Do It

The next section, "You Do It," provides an opportunity for the student to apply the information they have read, watched, and begun to learn in the How It's Done section. The You Do It section is focused on guided student activity. The course sets up a "practice field" (cite Duffy) in which the student applies information in a constructed learning space. Activities take the form of website visits, interactive animations, text -based problem scenarios, and others. The student is given more control over their own learning now, with opportunities to repeat activities, sometimes with different conditions. Some courses present several different activities that the student can choose from. We have seen students use "optional" activities in many different ways. Some students try every activity once and move on. Other students try each activity over and over until they master each. Still other students only work through one activity and then continue.

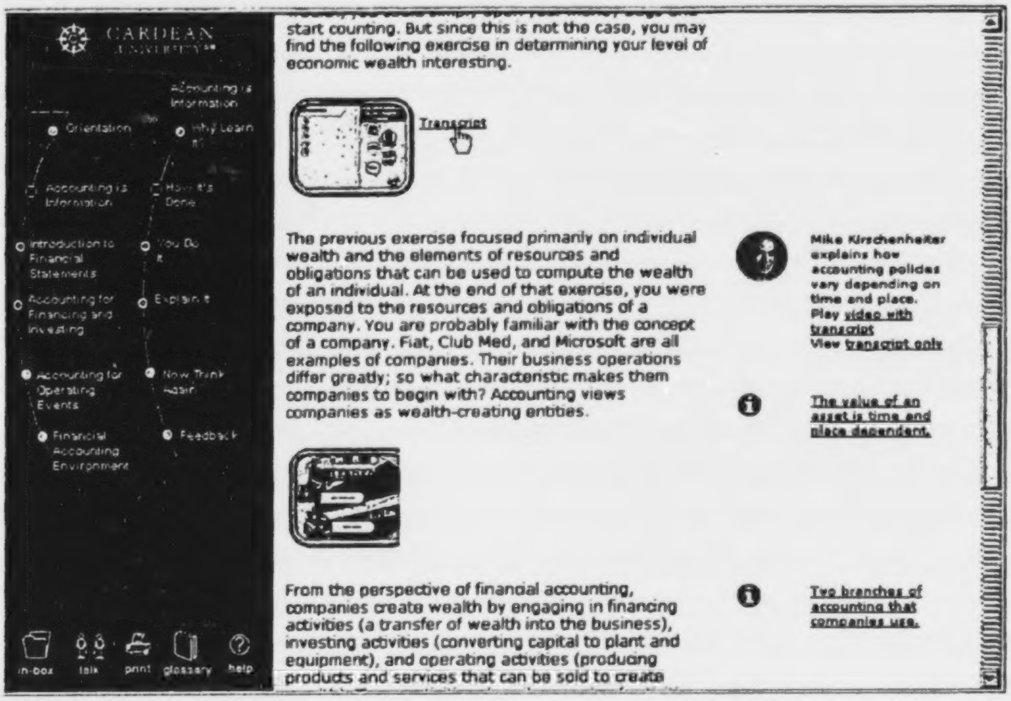
Explain It

The "Explain It" section presents the student with a chance to explain what they have learned by answering several free response questions. Students submit their answers and receive direct feedback after just a short wait (20-30 minutes). Questions usually require the student to use simple analysis, synthesis, or application skills to create fully correct answers. These questions provide an opportunity for the student to check their understanding and demonstrate that they are learning course content, and not just clicking through the course without much thought.

Now Think Again

The last section of each course, "Now Think Again," challenges the student to think about the course content in a new way – often in the context of his or her own work environment or from an alternative perspective (as an employees versus as a manager, for example). The course provides printable documents the student can "takeaway" from the course to help them implement new knowledge and skills in their work. Suggestions for further reading and helpful website references complete the course content, providing resources for the student to use after the course experience is finished. Many students report that this is one of the most useful sections of the course, especially links to relevant websites. In this section, the student is in almost full control of his or her own learning. The course content takes the form of a library of resources for the student to use as he or she applies new knowledge on their own in their own unique situation.

Figure 1. Cognitive apprenticeship course model: Learn to Speak Accounting.


CARDEAN UNIVERSITY
Accounting is Information
Orientation
Why Learn It?
Accounting is Information
How It's Done
Introduction to Financial Statements
You Do It
Accounting for Financing and Investing
Explain It
Accounting for Operating Events
Now Think Again
Financial Accounting Environment
Feedback
in-box
talk
print
glossary
help
Transcript

start counting. But since this is not the case, you may find the following exercise in determining your level of economic wealth interesting.

The previous exercise focused primarily on individual wealth and the elements of resources and obligations that can be used to compute the wealth of an individual. At the end of that exercise, you were exposed to the resources and obligations of a company. You are probably familiar with the concept of a company. Fiat, Club Med, and Microsoft are all examples of companies. Their business operations differ greatly; so what characteristic makes them companies to begin with? Accounting views companies as wealth-creating entities.

Mike Kirschenheiter explains how accounting policies vary depending on time and place. Play video with transcript
View transcript only

The value of an asset is time and place dependent.

From the perspective of financial accounting, companies create wealth by engaging in financing activities (a transfer of wealth into the business), investing activities (converting capital to plant and equipment), and operating activities (producing products and services that can be sold to create

Additional Course Features

This course model takes advantage of other features that contribute directly to its effectiveness. We use short video segments of experts, usually notable business professors, that highlight key points in the content or answer frequently asked questions. Links to video segments are located in the right margin of the course content page (see figure 1.). Transcripts of each video segment are included -- just in case there are technical limitations that preclude a student from viewing one of the videos. We use Flash animations to motivate student interest, explain complex concepts, and provide interactive exercises (see figure 2.). We provide transcripts for animations that explain concepts, since they often include core course content, and students occasionally experience technical difficulties when viewing animations. Finally, we use many "pop-up" windows to display additional information to the student. These pop-ups are indicated by standard hyperlink formatting, underlined blue text (see figure 1.). The types of information we present in pop-ups include; answers to course questions, additional reading material (articles, case studies, etc.) and glossary definitions. Pop-ups increase the level of learner-content interactivity, improving the overall student experience (Gilbert & Moore, 1998; Hannifin, Hill, & Land, 1997; Trentin, 2000).

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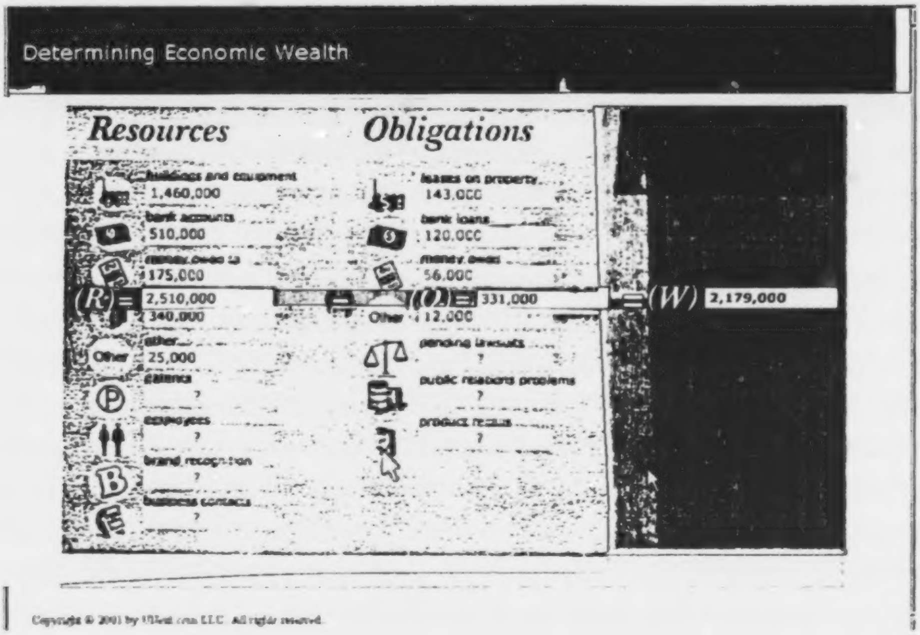
Figure 2. Interactive Animation


Determining Economic Wealth
Resources
Obligations
(R) =
(O) =
(W)
Other
Other
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buildings and equipment 1,460,000
bank accounts 510,000
money owed to 175,000
340,000
other 25,000
patents ?
employees ?
brand recognition ?
business contacts ?
(R) = 2,510,000

leases on property 143,000
bank loans 120,000
money owed 56,000
12,000
pending lawsuits ?
public relations problems ?
product recalls ?
(O) = 331,000

(W) 2,179,000

Sample Course: Learn to Speak Accounting

One of the courses created using this instructional model is titled "Learn to Speak Accounting." This course is designed to help non-accounting managers understand basic accounting principles so they can communicate with corporate accounting staff and manage their own business functions with more fiscal soundness. The target audience for this course is non-accounting managers: engineers, manufacturing, marketing, etc. managers who do not have an accounting background yet have (new) fiscal responsibilities that include making decisions that affect or that are affected by accounting systems. Sometimes, a new manager who does not have a financial background may tend to make business decisions for their unit or group without taking into account various accounting factors that could help them understand the flow of wealth within their company. A core assumption (and assertion) of the course is that understanding these factors can help managers make better business decisions.

A New Approach to Teaching Accounting

This course presents the concepts of accounting in a new way. Instead of beginning the study of accounting from the bottom up, by discussing debits, credits, and accounts, this course takes a "top down" approach, beginning with the grand issues of accounting, such as how to read annual reports. Specifically, the course begins by showing how accounting tracks the resources, obligations, and wealth of a company. These are presented in the company's annual report, an important document for business professionals. As the student examines the different parts of the annual report, the key concepts of accounting, such as different accounts and how transactions affect those accounts, are revealed. This top down approach is effective as it gets the student involved in a (more) familiar practice such as reading annual reports and then presents the more specific (and unfamiliar) concepts of accounting that relate to the report.

Key Course Features

Throughout the suite of LTSA courses, there are many opportunities for the student to practice applying the information and concepts introduced in the course. Many of these practice opportunities take the form of interactive

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(Flash) animations or visiting live websites and analyzing real accounting information from existing companies. Additionally, each How It's Done section in this suite utilizes an interactive (Flash) animation that requires the student to apply the course concepts in a realistic business situation. See figure 2. for an example of one of these interactive tools. This practice is focused on developing basic skills and understanding of the concepts just presented. Finally, in each You Do It section in this suite we challenge the student by asking him or her to apply the new information he or she has just read and explored through a visit to a real company's website. A sample of the tasks he or she may be asked to complete includes looking for general corporate financial performance in a company's annual report, exploring the detailed financial statements found in real annual reports, and comparing methods of accounting as evidenced in a company's annual report with common or accepted methods discussed in the course.

Problem Centered Learning

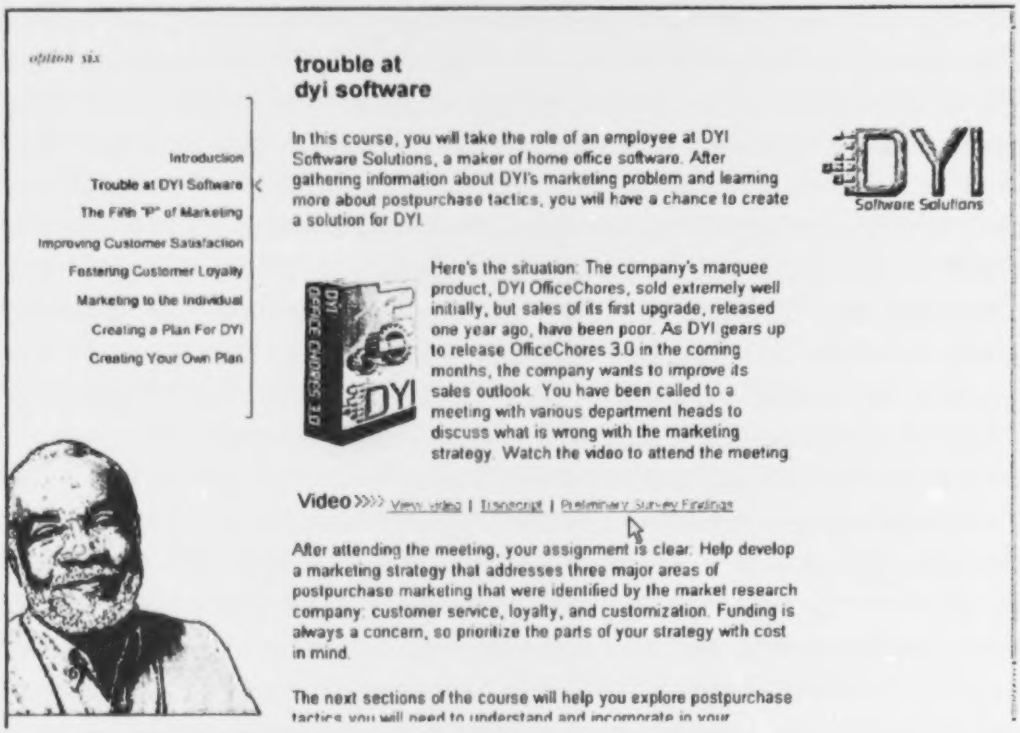
A second course model we have used uses a problem centered approach to design and instruction. Starting off by considering the problem the student is facing, or in some instances the "guiding question" the student is trying to answer, is helpful both for the student as they enter the course, but also for the design team as they create the instruction. Since most learning takes place as the result of a gap between what a learner knows and what a learner wants to know, starting with what exactly the learner wants to know (problem to be solved, major question to be answered) makes sense (Savery & Duffy, 1996; Merrill, 2000). After starting with the problem, the instruction must present the student with the resources and guidance needed to solve the problem or answer the guiding question. Providing multiple opportunities for practice and supporting the student as they leave the course and apply their new knowledge in their normal jobs is the final phase of this instruction. In essence, this course design includes four phases; problem (Why? What context?), information (What? How?), practice (I try with you), and transfer (I go it alone). This overall approach to instruction includes some elements of cognitive apprenticeship as well, since the student receives fading support or scaffolding as they progress through the course.

Sample Course: Post-purchase Marketing

This one to two hour course was designed to teach the concept of marketing after the sale – post-purchase marketing, to various levels of employees in a business. Everyone who comes into contact with customers, or whose work directly impacts a customer's experience after they have purchased a product (or service) from the company, should understand these concepts. On a large scale, this course is designed to help an entire organization understand the importance of after the sale marketing efforts. See figure 3 for the problem-setting page of the course.

The course sections are accessed using the navigation panel on the left. In this course, there is an Introduction section, a problem setting section, four sections devoted to new content information, a problem solution (practice) section, and a final section devoted to supporting the student's transfer of their new knowledge from their course experience to their own workplace.

Figure 3. Problem-centered Learning Course: Post-purchase Marketing


option six
Introduction
Trouble at DYI Software
The Fifth "P" of Marketing
Improving Customer Satisfaction
Fostering Customer Loyalty
Marketing to the Individual
Creating a Plan For DYI
Creating Your Own Plan
DYI Software Solutions
DYI OFFICE CHORES 3.0
Video >>>> View video | Transcript | Preliminary Survey Findings

trouble at dyi software

In this course, you will take the role of an employee at DYI Software Solutions, a maker of home office software. After gathering information about DYI's marketing problem and learning more about postpurchase tactics, you will have a chance to create a solution for DYI.

Here's the situation: The company's marquee product, DYI OfficeChores, sold extremely well initially, but sales of its first upgrade, released one year ago, have been poor. As DYI gears up to release OfficeChores 3.0 in the coming months, the company wants to improve its sales outlook. You have been called to a meeting with various department heads to discuss what is wrong with the marketing strategy. Watch the video to attend the meeting

After attending the meeting, your assignment is clear. Help develop a marketing strategy that addresses three major areas of postpurchase marketing that were identified by the market research company: customer service, loyalty, and customization. Funding is always a concern, so prioritize the parts of your strategy with cost in mind.

The next sections of the course will help you explore postpurchase tactics you will need to understand and incorporate in your

A New Approach to Teaching Marketing

The Post-purchase Marketing course takes a different approach to teaching marketing. Instead of starting the course with the concepts of post-purchase marketing, the student is presented with a business problem that needs resolution. A fictional company, DYI Software, is experiencing reduced sales and low customer satisfaction. The problem appears to be a failure in post-purchase marketing efforts. The student is given the task of learning about post-purchase marketing and then coming up with a new marketing strategy for the company. As the student moves through the rest of the course, they are presented with the key concepts of post-purchase marketing to help them in formulating their own strategy. Examples and interactive practice elements give the student the opportunity to apply principles learned before embarking on the strategy project for DYI. Throughout the course, the student has the opportunity to interact with other students, posting questions and ideas in the course discussion forum.

Key Course Features

This course uses many of the same instructional methods, tools, and techniques as the cognitive apprenticeship courses do. One additional feature we added to this course we call "embedded self assessments" (Beatty, Branon, & Wilson 2001). This feature was added to assist the student's self-regulatory behavior (Schunk & Zimmerman, 1998) during their learning experience (see figure 4). Embedded self-assessments (ESA) are short opportunities for students to assess their understanding while they are learning new course content. They are "embedded" in that they are included within blocks of content, not grouped at the end of a content section as is traditionally done in instructional texts. We believe that ESAs help students understand whether they are truly learning the course material *before* they get to the comprehensive assessment at the end of the course, *before* they attempt to apply course content in a practice situation. Additionally, students have reported that ESAs help them stay focused on the learning task at hand.

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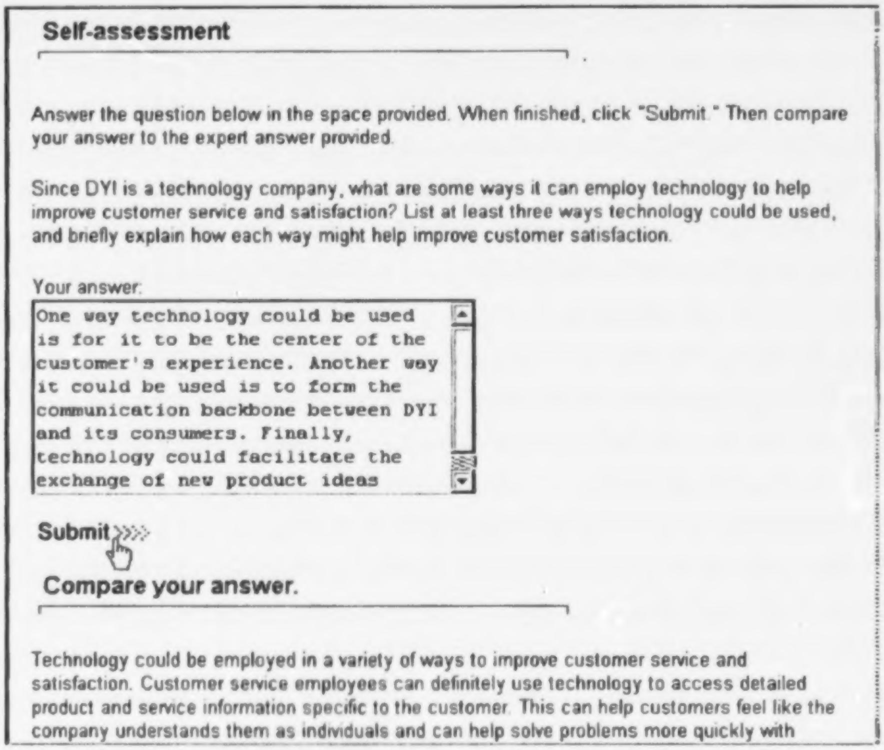
Figure 4 shows an example of the type of ESA used in the post-purchase marketing course. In general, we ask the student to answer a free-response question, and then provide an opportunity for them to check their answer with an "expert" response. Another type of ESA we have used is multiple choice with immediate feedback. We have found that different students have different ESA style preferences (Beatty et al., 2001), and different course content fits different ESA styles as well.

Figure 4. Embedded Self-assessment



Self-assessment

Answer the question below in the space provided. When finished, click "Submit." Then compare your answer to the expert answer provided.

Since DYI is a technology company, what are some ways it can employ technology to help improve customer service and satisfaction? List at least three ways technology could be used, and briefly explain how each way might help improve customer satisfaction.

Your answer:

One way technology could be used is for it to be the center of the customer's experience. Another way it could be used is to form the communication backbone between DYI and its consumers. Finally, technology could facilitate the exchange of new product ideas

Compare your answer.

Technology could be employed in a variety of ways to improve customer service and satisfaction. Customer service employees can definitely use technology to access detailed product and service information specific to the customer. This can help customers feel like the company understands them as individuals and can help solve problems more quickly with

ID Challenges

One course model fits all ...

One of the challenges to building executive education is that training departments often want a "on-size-fits-all" approach to courses. Having a single course model is easier to manage and track but the reduction in flexibility can detract from learning and motivation. For instructional designers, this can mean having to work with a less than ideal pedagogical structure for some topic areas. In the future, Learner Management Systems (LMSs) should become more complex in how they track learners, thus making it possible that this problem can be reduced.

Working with Subject Matter Experts (SMEs)

Finding SMEs can be a major hurdle for high-level online executive education. Ideally, a SME should be someone who is an executive and has experience in the narrow topic being covered. The obvious issue is that people with such credentials are extremely busy running companies or consulting and the incentive to have them develop an online course has to be high. Even when a person has been located with the correct skills and knowledge, they probably do not understand the instructional design process.

Working with SMEs has always been a challenge for instructional designers. When developing short, specialized e-learning, however, the difficulty can become acute. Because SMEs are experts, it is often difficult for

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them to write high-level pieces that need to be delivered in a short period of time. Additionally, the expert status of a SME means that they are not used to working in a team-based development environment. The process of negotiating can require astute political skills on the part of the instructional designer, especially when determining what content is 'critical' for an executive level course.

Can accounting really be made motivating?

Unless a person works as an accountant, a course in accounting is probably not one that would be taken by choice. Accounting skills, however, are important for managers at nearly every level. They might not need to be able to handle accounting functions directly, but having a working knowledge of accounting fundamentals can improve their ability to run their department. By understanding this perspective, an instructional designer can build a course that is interesting and motivational for a variety of executive learners.

Learner persistence

Even if a course is short and filled with motivating animations, videos, and content, business managers are always very busy. The temptation can be to move through the training module as quickly as possible. Simply paging through screens does not mean that learning will occur yet, emphasizing this to someone with limited time can be difficult in an online environment. Keeping people on task and focused will in an online environment will likely continue to be a vexing problem for designers.

Ongoing Research

We are engaging in ongoing research projects at Option Six to help us understand online learning better and focus on creating more effective learning environments for each of the instructional situations that we encounter. The corporate environment we find ourselves in is very supportive of focused research that contributes to more effective learning, better overall training solutions, and ultimately more satisfied customers. The projects we are currently pursuing include:

The use of self-assessments in Executive education courses – looking at student perceptions of learning, and actual conceptual learning in courses that use embedded self-assessments.

Self-regulation in self-paced e-learning – how can we better support learners through the instructional design and technical features of an online course?

The use of blended learning solutions – when should students interact asynchronously? When should the course include synchronous meetings? Should part of the training be implemented face-to-face?

Social interaction in online learning – when should social interaction be used in an online course? What conditions should be considered when choosing specific instructional methods?

Conclusion

In closing, we have found that several course instructional models have been effective in creating Executive Education courses that are based on solid instructional theory, that students like, and that actually teach students the course content. Creating effective, engaging courses is challenging and difficult. Following solid instructional design blueprints while still allowing for appropriate divergence and variability based on content, student, and client needs has been a successful strategy for us. We are continuing to study the course models and essential course features we have created and used in our attempts to understand and implement the most effective instructional approaches for business audiences. Expanding our instructional design research to include the emerging issues and concerns of business-focused e-learning promises to be an enjoyable and rewarding venture, in both a theoretical and practical sense. The opportunities are endless.

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Systems Design: An Analysis of the Implementation Process of Taiwan's Constructivist-Approach Elementary Mathematics Curriculum

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Abstract

The purpose of this paper is to analyze the implementation process of Taiwan's constructivist-approach elementary mathematics curriculum in terms of Reigeluth's guidelines for the system design process.

Introduction

The implementation of Taiwan's nationwide constructivist-approach elementary mathematics curriculum has been ongoing for five years. Not surprisingly, as time passes, problems related to this implementation process become increasingly evident. This situation is complex because it not only reveals those difficult issues directly related to the epistemology and instructional methods of mathematics, but also, more seriously, those ones associated with the troubles of Taiwan's entire educational system. From the perspective of systems thinking, Taiwan elementary educational system's mindset as a whole is troubled, and is unable to coordinate with the surrounding community in order to better educational standards.

Taiwan's case is worth examination as it serves as an exemplary case of difficulties associated with the redesign of an educational system. The goal of this paper is to analyze the problems linked to the reform and implementation of Taiwan's elementary constructivist mathematics curriculum. This paper will begin with a brief introduction on the new trend in Taiwan's elementary constructivist mathematics curriculum. I will then discuss the difficulties associated with implementation, and the problems caused by those persons in the education community who have a distorted perspective on the reform. Finally, I will examine these problems utilizing Reigeluth's guidelines for the system design process for more comprehensive and systemic understanding of the situations.

An overview of the new trend in Taiwan's elementary mathematics curriculum

Moving away from the objectivist tradition of didactic and authoritative mathematics education, the Republic of China's Ministry of Education mandated a constructivist approach to the province's elementary mathematics curriculum agenda (Ministry of Education, R.O.C., 1993). Taiwan's elementary mathematics curriculum adopts two major views of constructivist approach: the individual cognitive mainly driving from Piaget (1977) and his followers, and social-cultural mainly driving from Vygotsky (1978) and his followers (Taiwan Province Public School In-Service Teacher Training Service, 1995).

> Individual cognitive view "...emphasizes the constructive activity of the individual as he or she tries to make sense of the world. Learning is seen to occur when the learner's expectations are not met, and he or she must resolve the discrepancy between what was expected and what was actually encountered. Thus, the learning is in the individual's constructions as he or she attempts to resolve the conflict, or alternatively put, individuals literally construct themselves and their world by accommodating to experiences...From this perspective, the importance of the teacher and other students is as a source of perturbation or puzzlement as a stimulus for the individual's learning...Hence, within this framework, the focus is on the individual within the group, and cognition occurs in the head of the individual." (Duffy & Cunningham, 1996, p.175)
>
> Social-cultural view "...emphasizes the socially and culturally situated context of cognition...This approach examines the social origins of cognition, for example, the impact of an individual's appropriation of language as a mediating tool to construct meaning. Collective actions become the focus, as in Rogoff's (1994, p. 209) learning communities, where 'learning occurs as people participate in shared endeavors with others, with all playing active but often asymmetrical roles in social-cultural activity.' It is the changes of ways in which one participates in a community which are crucial, not individual constructions of that activity...Learning, then, is a process of acculturation, and thus the study of social and cultural processes and artifacts is central..." (Duffy & Cunningham, 1996, pp.175-176)

Publishers designed their elementary mathematics instructional methods based on these two approaches. These instructional methods were implemented nationwide in 1996, beginning with first-grade students.

Examining the problems of implementation

Since 1996, obstacles faced by proponents of reform have become increasingly great. These problems have already hindered the reform's effectiveness, and have even distorted the Ministry of Education's original intentions (Chen, 2001; Chen, 2001; Huang, 2001). As a matter of fact, the original intentions of this reform were to provide learners with opportunities to truly understand mathematics, to discuss mathematics and to collaborate in efforts to solve problems, just as the community of mathematicians did (Huang, 1996). Unfortunately, such intentions did not come into fruition, as many teachers rejected the new instructional methods (Chen, 2001; Chen, 2001; Huang, 2001). Opposition was so great that there were even teachers who planned an early retirement in order to avoid change. A significant number of people in the education community (By this term, I mean officers, professors of education, researchers, and teachers not directly involved in this reform) were unaware of this nationwide mandatory reform. Many parents were against it, and most community members, like those in the education community, did not know of it.

The obstacles above are by no means caused only by issues of the constructivist instructional method itself. They are closely linked to the issues of systemic thinking and the system design process. Due to the lack of insight in viewing this reform as one related to a systemic transformation (a systemic design and implementation process), this reform has encountered enormous obstacles. The current reform of Taiwan's elementary curriculum, like many other past educational reforms, has fallen into the rut of using a piecemeal approach in a desperate attempt to improve fragmented and outdated educational reforms. If educators truly wish to succeed in creating a better educational program, they must abandon such an antiquated approach and instead, focus their attention on the systems design approach.

One must understand that the reform of one or two educational paradigms often affects other aspects of the educational system. The reform of Taiwan's elementary mathematics education is no exception. As Reigeluth states:

> For a fundamental change in education to be lasting and effective, it must be a systemic transformation–one in which changes pervade all aspects of the educational system to account for inter-dependencies among parts of the system. If the change is truly pervasive, it will have an impact, not only on learning in the classroom, but throughout the school and administration, as in the community where it occurs. (Reigeluth, 1990, p.)

The systems design approach directs educational systems design toward a sweeping, comprehensive transformation. Unless we use a systemic approach to review the problems and solutions, we will not be able to give appropriate suggestions for solutions.

In the following section I will use Reigeluth, Norris, and Ryan's "Major Guidelines for the Redesign Process" to analyze the design and implementation of Taiwan's elementary constructivist mathematics curriculum. I believe this approach will guide our mindset to view Taiwan's case in a radical yet systemic way, and help us to build a more comprehensive blueprint for restructuring the educational system so that it may support a constructivist mathematics instruction.

Analysis

Table 1: MAJOR GUIDELINES FOR THE REDESIGN PROCESS

(Adopted from Reigeluth, 1991, p. 9)
Guidelines
Initiating the process:
1. Appraise the climate for systemic change.
2. Make sure you have powerful instigation.
3. Build a school and community coalition of restructurers.
4. Build public support for the change.
5. Document the experience from the beginning.
Design the new system:
6. Involve all stakeholder groups in deciding on and carrying out the design process.
7. Get good leadership and outside facilitation.
8. Develop a common mindset for the new paradigm.
9. Design a feasible model for the system.

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10. Establish and maintain communication links.
Planning the implementation:
11. Experiment with tryouts and pilots, and make revisions.
12. Designate time and funds to develop and participate in staff development.
13. Designate time and funds to procure learning resources, and equipment and to remodel facilitation.
14. Obtain active resource support from all stakeholders.
Implementing the design:
15. Allow parents to choose to send their children to the new system.
16. Institutionalize the change process with regular formative evaluations by the stakeholders.
17. Maintain communication with stakeholders, non-participants and outsiders interested in systemic restructuring.
18. Allow three years before doing a summative evaluation.

The above chart outlines the eighteen guidelines proposed by Reigeluth, Norris, & Ryan (1991) to direct the four phases of the educational redesign process. In the following section, I will elaborate on the condition for each guideline.

Initiating the Process

Guideline 1: Appraise the climate for systemic change

Most of the critical players in Taiwan's educational reform did not harbor negative feelings toward the existing system before the reform started; subsequently, they were seemingly unaware of the urgency for a reform of the mathematics curriculum. The motivation for change, in large part, can be attributed to suggestions from two groups: a large number of college-level mathematics education professors and researchers, and a handful of elementary school principles and mathematics teachers who were aware of international trends in elementary mathematics education. These persons proposed to Taiwan's Ministry of Education that Taiwan's official elementary mathematics curriculum be revised; the Ministry of Education authorized them to do so and appointed key figures to edit mathematics textbooks and resources.

Judging from the above, it is apparent that the reform was not a grass-roots action lead by the needs of elementary school teachers, administrators, and parents. Thus, many teachers continue to use traditional instructional methods to teach the new mathematics curriculum. There is no climate for change for the mathematics instructional method, and needless to say, there is no fertile ground for a systemic change of the entire educational system that would support the constructivist mathematics curriculum.

Guideline 2: Make sure you have powerful instigation

Usually, elementary school principals enjoy a great deal of power because they have been directly appointed by Taiwan's Ministry of Education, not the school board. Moreover, the Ministry of Education authorizes them to decree school policies and the administration of educational reform. As principals, the above tasks constitute their primary job responsibilities, and are the basis for promotions. Therefore, school principals are the ones who are most vocal in their support of educational reforms. In contrast, staff members, general administrators and teachers tend to be passive because of their fear of change and their unwillingness to accept the additional burdens associated with such change. Consequently, the principals often have a difficult time finding teachers willing to participate in the reform. Principals often try to find highly motivated and respected teachers to serve as instigators of the reform. If the principals are unable to persuade a sufficient number of such educators, they often order young teachers, who tend to be more obedient to the principal than experienced teachers. In Taiwan, community members (parents, business leaders and other influential persons) seldom become involved actively in school activities. The bulk of school funding comes from central and local taxes, not from businessmen's donations.

Guideline 3: Build a school and community coalition of restructurers

As stated above, community members were far removed from school activities; therefore, there were virtually no partnerships between schools and community members in the school reform process.

Guideline 4: Build public support for the change

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Reform took place almost completely in professional, educational circles. Community members, even the students' parents, did not know much of the reform. Over the past few years, the media has only sporadically reported these events; such issues tended to appear solely in scholarly periodicals that deal with education. Meanwhile, the constructivist mathematics curriculum quietly developed on school campuses.

Guideline 5: Document the experience from the beginning

Taiwan's official model of constructivist mathematics curriculum was tested in several schools over a four-year period before it was deemed fit for application nationwide. A great deal of qualitative and quantitative research has documented the different phases of implementation, for example: teachers' changes in pedagogy (Ko, 1996), the process of instruction (Tzeng, 1997), and students' achievements and shifting attitudes toward mathematics (Chung, 1997). The research results came in both print and non-print forms, and were quite useful. Unfortunately, because of limited quantity and circulation, teachers, parents and administrators did not have many opportunities to access them.

Designing the new system

Guideline 6: Involve all stakeholder groups in deciding on and carrying out the design process

As stated above, only a few mathematics professors, researchers, administrators and teachers initiated and developed this new curriculum. The stakeholder groups in the majority of schools were not involved in the design process. Thus, they were neither familiar with nor enthusiastic about the reform; they could not play the role of advocators for the new curriculum.

Guideline 7: Get good leadership and outside facilitation

Owing to the limited number of persons trained in the new curriculum, there were not enough teachers to demonstrate it in the 2,583 elementary schools throughout Taiwan. Normally, teachers who were somewhat familiar with the new methods simply would supervise their colleagues, or teachers from the same school would form collective training sessions, through which they could learn from each other.

Guideline 8: Develop a common mindset for the new paradigm

Unfortunately, most of those involved in the reform viewed it more in terms of curriculum and instructional methods, rather than in terms of a fundamental change of mindset about education. The reformers failed to create a special atmosphere for sharing common values and goals.

Guideline 9: Design a feasible model for the system

Educators published several instructional models on constructivist mathematics. These models were feasible, and came with teacher's manuals, so they were not too difficult to teach from. However, I think the problems are not in these instructional models, but the problems behind the instructional models and those on the periphery. By "behind," I mean the epistemology and assumption of learning. Peripheral problems are training and diffusion issues. These have been or will be discussed in each guideline, so I will not elaborate on them here.

Guideline 10: Establish and maintain communication links

Communication links entail internal communications such as holding regular public meetings and utilizing various media, and external communications such as linking up with other schools and joining networks (Reigeluth et al, 1991). Not surprisingly, these links were scarce within schools and between schools.

Planning the implementation:

Guideline 11: Experiment with tryouts and pilots, and make revisions

Among the publications implementing elementary constructivist mathematics, only the textbooks designed and developed by Taiwan's government agency were used in the four-year pilot program. The rest of the textbooks did not go through this process, therefore, they created a significant amount of confusion among teachers. This situation proves that the testing process is necessary.

Guideline 12: Designating time and funds to develop and participate in staff development

Neither substantial time nor sufficient funding has been provided to facilitate the diffusion of the reform.

Guideline 13: Designate time and funds to procure learning resources, and equipment and to remodel facilities

The lack of time and funds was regarded as the most frustrating situation for teachers. Teachers complained that, even though there were enough constructivist mathematics instruction resources for them to use, there was a lack of quality instructional media to go with each lesson in the new curriculum.

Guideline 14: Obtain active resource support from all stakeholders

This reform was mandatory, so all stakeholders were supposed to contribute as many human and material resources as possible to the implementation efforts. Teachers also had the obligation to contribute to the implementation efforts. However, this was a mandatory and not a grass-roots action; as a result, not all stakeholders and teachers were involved in the implementation. Some stakeholders rejected the training and opted for early retirement.

Implementing the design:

Guideline 15: Allow parents to choose to send their children to the new system

Since this reform was mandatory, all Taiwanese elementary schools, private and public, took the identical approach to instruction. Parents did not have a say in the matter.

Guideline 16: Institutionalize the change process with regular formative evaluations by the stakeholders

Reigeluth mentioned three kinds of strategies for this guideline: evaluate the system continuously, include all stakeholders in a shared governance system, and consider an equitable choice plan and incentive system to encourage continual systemic change. I do not know if these strategies occurred in Taiwan's case; I need more time to investigate these issues. Regardless, the reform often times dies off within a few years due to a lack of these strategies.

Guideline 17: Maintain communication with stakeholders, non-participants and outsiders interested in systemic restructuring

Taiwanese schools often are isolated from the surrounding communities. These institutions lack a comprehensive channel of communication between those inside and outside, participants and non-participants, or even among stakeholders. Schools tend to introvert themselves, and this closed system is not conducive to reform.

Guideline 18: Allow three years before doing a summative evaluation

To my knowledge, there is no plan yet to conduct a nationwide formative or summative evaluation of this reform. Small-scale formative evaluations on students' achievements in mathematics and attitudes toward the new curriculum were carried out (Chung, 1997).

Conclusion

In this paper, I started with the significance of the study of the implementation of Taiwan's constructivist-approach elementary mathematics curriculum. I briefly described its new trends and revealed the problems related to such educational reform by examining the difficulties associated with the implementation of this curriculum. In order to achieve an appropriate perspective to view these problems, it was necessary to utilize a systems design approach rather than a piecemeal approach. Reigeluth's guidelines for the design process were used to analyze the situation. These guidelines guided us to view these situations both comprehensively and systematically through four phases of design process. Therefore we did not miss any essential process to be trapped into a partial perspective, like the blinds touched an elephant. Further, they will continue to guide us on how to take action for future reform action.

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Integrating Technology and Inquiry Pedagogy: Needs-Based Professional Development

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Introduction

In recent years, academic deficiencies of U. S. science students have been of primary concern to both the U. S. Department of Education (Henry, 1997) and the National Research Council (NRC) (1996). More specifically, Georgia students scored in the lowest 25% of students tested in 40 states and 51% scored at the "below basic" level of understanding science. In light of such reports, strategies to improve science teaching and learning have become a focus of professional development efforts around the country.

Due to the dynamic nature of teaching and learning science in our modern, technological world, it would be reasonable to assume that teachers, not just their students, should be dedicated learners. The job of teaching must be redefined to include continuous teacher learning (Berlin, 1996). According to the National Science Education Standards (NSES) (1996), learning has a two-fold purpose in science education: (1) to keep current in science and (2) to deepen the understanding of effective science teaching strategies. Such educational strategies should be aligned with the NSES to include science as inquiry, utilization of technology, and collaboration among educators. Additionally, successful professional development activities provide explicit connections to teacher needs as well as a sense of ownership in the learning process.

The NSES clearly outlined objectives for teaching and learning science. Paramount to all science education was science as inquiry. Inquiry, the watchword of constructivist reform, dictates that any knowledge and understanding must be (1) actively acquired; (2) socially constructed; and (3) created and then recreated for individualized meaning (Perkins, November 1999). NSES guidelines vary greatly from the passive mode of learning that pervades education today, and logically teachers would require substantive support and education to master the inquiry techniques advocated.

As students become more fluent with technology, it is imperative that educators, as well, increase their technological comfort level and rise to meet the needs of their students. According to Jane Healy, as cited in Tell, (October, 2000), technology is a great gift to education and affords teachers and students opportunities to initiate important learning. Such learning, while easily aligned with constructivist ideals, must be planned and guided by teachers. Fundamental, then, to any professional development effort is providing school staff with ongoing training to increase teacher fluency as well as link technology with authentic work (Dooling, October, 2000).

Finally, as mandated by the NSES, collaboration should be at the heart of teaching and learning. As mentioned previously, constructivist learning is a highly social process. Knowledge and understanding for students and teachers are constructed in dialogue with others (Perkins, 1999).

A regional university of the University System of Georgia, Valdosta State University (VSU), fulfills the academic needs of the South Georgia area. The area serviced by VSU contains a high proportion of minorities and students from economically disadvantaged families. Student performance on the state mandated science assessment, the Georgia High School Graduation Test, was well below achievement levels compared other subject areas (Georgia Department of Education, 1999). VSU must reach out to science teachers in the area to improve teaching skills if their students are to become productive, contributing members of local communities. It was with these needs in mind, that the inquiry learning and technology utilization project for middle grades and high school teachers was developed.

The educational significance of this study was to advance the existing body of knowledge and improve science classroom instruction by assisting middle and high school teachers to (1) become knowledgeable and proficient with inquiry-based teaching consistent with both state and national education reform efforts (GIMS, 1996; NRC, 1996), and (2) obtain necessary experience and skills to incorporate instructional technologies into the inquiry-based teaching format. Due to the one-year length of the project, teachers were supported through concerns identified with the three distinct stages of change implementation: preparation, acceptance, and commitment (Rogers, 1996; Salisbury, 1996) allowing discipline-wide adoption and considerable change in practice to be achieved.

Review of Related Literature

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Worthwhile educational changes require new knowledge, attitudes, and behavior (Fullan, 1991). A striking departure from the classroom norm, constructivist theory and science as inquiry demands the active participation of the learner, not passive receptivity. The authoritative role previously played by teachers has been transformed into one of facilitator (Mancino, 1995). Additionally, while there are growing pressures for teachers to embrace technology in the classroom, where there exists no specific mandate to do so, there will be continued reluctance on the part of teachers to change from what is familiar and comfortable (Robinson, 2000).

Professional Development

Dorit (1999) hypothesized that professional development programs should put teachers in the role of learners in an attempt to facilitate epistemological change and influence their use of technology and constructivist teaching practices. Within the realm of a multimedia constructivist program, science teachers worked cooperatively, with minimum supervision, and conducted investigations regarding the utilization of a multimedia package in their classroom. The study suggested that collaboration, time for reflection, and active teacher participation as learner all contributed to the success of inquiry-based learning and a change in teacher thinking.

Effective professional development for science education should draw from a synthesis of standards posited by the NRC (1996) (Loucks-Horsley, Stiles, and Hewson, 1996). Included in these standards is the development of a learning community. Stein (1998) provided a view of professional development at its best: a systemic investment in building teacher capacity through collaboration. In this case, professional development was seen as everyone's job and everyone viewed themselves responsible not only for their learning but also for the learning of colleagues. Such a collaborative effort led to teacher change, a newly implemented constructivist approach to teaching and learning, and improved student performance district-wide.

Teachers, like students, learned science as inquiry best by doing science as inquiry by investigating for themselves, and building their own understanding (Supovitz, Mayer, and Kahle, 2000). A standards-driven inquiry-based professional development effort in Ohio produced strong, positive, and significant growth in teachers' attitudes toward inquiry-based instruction, as well as their use of inquiry in the classroom. Not only did change occur, it was sustained for up to three years following involvement.

In a five-year, longitudinal study, Berlin (1996) evaluated the effects of action research on teacher attitude toward inquiry, as well as improved teaching and learning. Berlin's model mimicked the stages of the learning cycle: Awareness, Research and Development, and Application. Not only were science educators introduced to the philosophy of science as inquiry, professional development strategies were inquiry-based. To repeat, teachers learned inquiry by doing inquiry. Quantitative and qualitative data suggested that inquiry-focused action research enhanced teacher attitudes towards both educational research and inquiry-based instruction. Additionally, action research facilitated the implementation of educational innovations in the classroom and improved teaching and learning.

The results of past learning cycle institutes, sponsored by the National Science Foundation, have documented long term changes in teaching strategies of the participants (Marek, Haack, and McWhirter, 1994). Most significantly, 93% of participating science teachers continued to use learning cycles in their science programs nearly a decade after the institute. Teachers stated that the learning cycle procedures:

- Involved students actively in the learning process
- Produced deeper understanding and greater retention of concepts
- Developed students' thinking and communication skills
- Included teaching process as well as content
- Made science relevant and meaningful to students.

As mentioned previously, teachers learned inquiry by doing inquiry. If, indeed, the learning cycle so greatly impacts student learning, one would expect similar results on teacher learning as well.

Methods and Procedures

Participants

The participants of the research project included 50 public school teachers from four counties in South Georgia, certified to teach either middle grades or high school science. A Florida group included 20 teachers certified to teach grades 4 – 12.

Procedure

Exploration phase. Science teachers met for five days during the summer from 9 a.m. to 3 p.m. During the first ninety minutes they attended seminars lead by science education professors to examine (a) the structure of science; (2) the nature of human learning; and (3) authentic assessment strategies for student evaluation in learning cycle curricula. Teacher-participants spent the rest of each day in laboratory session lead by project staff. These sessions included (1) technology activities designed to familiarize teachers with the use of various educational technologies and (2) science laboratories modeling the learning cycle procedure led by in-service middle and high school teachers experienced in inquiry teaching.

Application phase. Once school started in August, teacher-participants met with project staff every alternate Saturday for eight weeks from 8 a.m. until 3 p.m. Teachers received copies of learning cycle curriculum, and with the assistance of project staff, modified two weeks of current science curriculum into inquiry-based lessons. Successes and difficulties of implementation were discussed on a regular basis.

Follow-up phase. For the remainder of the school year a member of the project staff conducted four observations of each participating teacher utilizing the learning cycle in the classroom. Following each observation, a meeting between teacher and staff member was conducted to discuss implementation of inquiry-based teaching procedures, incorporation of technology, assessment, or other factors associated with teaching change. In addition to individual meetings, two meetings with all teachers and project staff were conducted to brainstorm solutions to problems and to share successes.

Instrumentation

An Advisory Panel, consisting of a scientist, educational technologist, certified Teacher Support Specialist, two middle school and two high school teachers, and two science education professors, developed a preliminary survey administered previous to participation in the summer workshop and designed to measure teacher attitudes and pedagogy. A follow-up survey was designed to measure attitudinal change immediately following the Saturday workshops. Teacher observations were conducted using a checklist developed in conjunction with survey data and teachers submitted reflective responses during follow up sessions. Student achievement was ascertained via pre and post subject-matter tests administered by participating teachers.

Results

Students

Student pre and post-test data indicated adequate to high levels of science achievement. More importantly, teachers noted, via reflective writings, an increase in student enthusiasm. Students appeared genuinely eager to be engaged in science and actively participated in providing suggestions for classroom investigations. One teacher noted how the inquiry format facilitated learning for all students. Non-reading middle grade students could readily participate in hands-on science activities while she monitored their learning through performance based assessments rather than traditional paper-and-pencil items. Another teacher commented on the development of classroom cooperation through increased use of inquiry activities. Inclusion students, usually excluded from science learning due to the traditional lecture format, were now able to actively participate within cooperative inquiry groups.

The spirit of cooperation and inquiry spilled over into other learning opportunities as well. A student in a tech-prep biology class instructed classmates how to use PowerPoint to present data collected during an inquiry activity while another student taught classmates in ecology how to use the school's digital camera to record data for a science investigation. Cooperative activities lead to instances of shared responsibility in other areas as well. When a student acted inappropriately on the school grounds while looking for rocks, the teacher took that opportunity for the class to look for solutions to resolve the incident.

At first glance, many classrooms seemed noisy and disorderly. In reality, after implementing inquiry activities and increasing student input, teachers had fewer discipline problems. Active engagement in learning science really was just that and students who were busy doing science did not have time to cause problems.

Teachers

Teacher response was overwhelming positive. Answers to attitudinal survey questions ranged from "agree" to "strongly agree". Not only did the participants state that the professional development addressed their needs, they also stated at the end of the weeklong meeting, that they agreed with the educational approaches presented and would be able to incorporate both inquiry and technology into their daily lessons. Individual comments included such things as "empowering", "energizing", and "a reminder that science is supposed to be active and exciting".

Additional meetings and correspondence with teachers indicated unwavering support. At the initial 2-week interval meeting, one group of middle school teachers had converted 10 weeks of lesson plans to inquiry format. Lack of textbook support materials caused some teachers to voice concern, but the support of the project's master teachers spurred them on the inquiry path. One early disbeliever, by the third meeting, had taught an entire three-week science unit using the inquiry format. She gave credit for her conversion to the master teacher who helped her design the unit.

If there was a single result that stood out among all others it was the evolution of teachers to teacher-collaborators. After the summer session, teachers shared a vision of change in the science classroom. Incorporating technology and modifying existing curricula to an inquiry format is a huge task for one person. Recognizing that there is strength in numbers and acknowledging the skills of some to lead the way, the groups of teachers from each system became collaborators. As 2002 is also science textbook adoption year, teachers have decided to collaborate on the selection of textbooks to facilitate incorporating the goals of this project. There are plans to develop a web site for sharing of ideas and inquiry formatted lesson plans as well.

Individually, one teacher commented on how the newly generated student enthusiasm for science as energized her as well. A physical science teacher discussed how this format seemed more efficient to her since many of her students rarely read the material in the text anyway. Once their interest was piqued by the inquiry activities, they were more likely to go back and read pertinent textual information. Another science teacher recently relegated to P.E. duty, incorporated inquiry activities into the health/P.E. arena by guiding students through an investigation of respiration, pulse rate, and physical activity. She commented on what a great opportunity that provided for integrating health, science, and mathematics in an otherwise academic-free zone.

On a broader scale, teachers acknowledged the importance of the support offered by the project staff. One teacher commented on previous staff development activities: "They spend a day or two with you and then they leave. You don't know what to do and no one else does either." In contrast, the continued support by the project leaders in this instance was empowering. The same teacher added: "I know I can count on this group (project leaders) if I need help."

The support by the project members and co-workers has inspired several veteran teachers to venture into uncharted territory. Traditional lecture-driven classrooms were coming alive with the noisy hum of inquiry activities. Teachers who never wanted a computer in their room now were asking for several student computers to be installed. One school system, in support of their science educators, applied for and received a $125,000 math and science technology grant. This money will be spent on installing a presentation station in each science classroom as well as purchasing a set of 15 laptop computers with Internet access.

Conclusion

Transformation may be the watchword of education today. As we charge into the information age, priorities and paradigms shift. What was valued a few decades ago, mass-produced knowledge, has been replaced by individually constructed knowledge. Active replaces passive. Teachers, too, must become active learners to master the changing scene in education, a scene that requires science as inquiry and the integration of technology. The key concepts described in the NSES formed the foundation for this project through the use of inquiry-based learning cycle teaching procedures, technology integration, and system-wide collaboration of science teachers. Worthwhile educational change requires new knowledge, attitudes, and behaviors (Fullan, 1991). The inquiry-technology integration project seemed to effectively supply these key requirements to science educators in South Georgia.

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Integrating Internet-based Learning In An Educational System: A Systemic Approach

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The first time we taught an online class, we didn't tell anybody that was what we were going to do. In 1996 when we first conceived of teaching a class on internet-based learning using the medium of internet-based learning, we weren't entirely sure how we would go about it. And given the myriad of rules and regulations associated with public higher education such as contact hours, new course approvals, and teaching evaluations as they relate to tenure and promotion, we thought it best that we keep things quiet less they go very, very wrong. Whether or not our first class went very, very wrong is open to debate, but our online course is no longer a secret (Harmon & Jones, in press; Harmon & Jones, 1999; Jones, Harmon, & Lowther, 2002; Jones & Harmon, In Press). Online courses are being taught at established universities and newly founded virtual universities. Department chairs, Deans, and Presidents are all anxious to put classes online. Position announcements specifically request people with online teaching experience, and course loads are defined by online courses. For better or worse, online courses are here, apparently to stay, and university teaching may be fundamentally changed as a result.

But teaching is only one part of higher education. For those of us working in the academy, we recognize immediately that what we teach and how we teach impacts our time and resources. And time and resources impact everything else we are asked and required to do. Consequently a fundamental change in teaching will also change how we do other things in higher education, such as research and service.

While we have defined varying levels of Web-based instruction (WBI) (Harmon & Jones, 1999), here we would like to take a broader look at WBI as it applies to higher education. Specifically, we are attempting here to define the educational system under girding higher education. Our purpose here is to identify the various components of the system to illustrate how and where they interact, overlap, and come together so that we may better understand how WBI may impact higher education. To that end, we must first define an educational system in order to define our educational system, higher education.

Defining an Educational System

Banathy (1995) argues that modern society imposes on us complexities that cannot be dealt with by traditional reductionist methods of science. In this era of rapid information flow human systems interact with their environment in fluid and dynamic ways. There are too many interacting variables to allow easy problem solving; perhaps the best we can hope for is "problem management." But in order to achieve even this level of control we must first understand our systems and how they operate. This need becomes even greater in light of the additional complexity potential resident in the vast, chaotic amalgam that is the World Wide Web. Realizing that entire textbooks have been written on systems and systems theory (i.e. Banathy, 1968; von Bertalanffy, 1968), our goal here is to provide a few simple guidelines for consideration when implementing WBI.

Principle 1: A system is a set of organized components working toward a common goal.

Every educational system is working towards a common goal, whatever that goal may be (Banathy, 1991). For a corporate environment, that goal may be to increase revenue. If we consider a retail environment for a moment, the training of new sales people will put more people on the floor working with customers effectively, which may increase customer satisfaction, which can generate increased sales, which in turn drives profits and ultimately corporate revenue. But training can be costly for the company. The organization must pay not only the wages of trainers and students, but also the costs of developing the training and the associated costs of travel, lodging, per diem and lost productivity. An organization must decide, based on its goals, what training should look like, how much it can cost, and how ultimately it meets the goals of the system. Being able to align strategic goals and missions of the system to the training environment, assures replicability, and allows for precise troubleshooting when some component of the instruction fails (Dick & Carey, 1996).

Principle 2: A change to one component of a system may cause a change in every other component of that system.

Understanding this idea is central to an effective use of Web-based Instruction. For most of us, WBI is a very different way of doing business than that to which we are accustomed. When we make the often radical change to WBI we run the risk of causing drastic changes in the rest of our organization. Offering a course on the Web requires us to reconsider aspects of the system that we often take for granted. How will the change affect textbooks? What will become of custodial services? What happens to corporate and university libraries when students are no longer on campus? Will scheduling change from the purview of facilities to the purview of information systems? These and numerous other issues will need to be considered. Remember the lesson of chaos theory, that a butterfly flapping its wings in Brazil can create a hurricane in Texas (Gleick, 1987), only changing to WBI is not so much like a butterfly flapping its wings as it is a jet plane revving its engines.

Principle 3: Every educational system is different.

While general systems theory holds that there are elements common to systems, every system is unique. Every system has particular features about it that provide its strengths and weaknesses. There do exist macro level pieces of a system that may be common to any educational system. Students, instructors, assessment, delivery, and management can be common to all environments. However, different environments will have different requirements. For example, the instructors in a corporate environment may have no other responsibilities beyond those associated with the classes they teach. In higher education, however, instructors often have not only teaching responsibilities, but research expectations and committee assignments as well. While both may be involved in instruction, the other components of the system will vary. Analysis of your own system and its particular requirements is important to before training begins.

It is important to note that we are working within the framework of Higher Education here. While we have written on WBI in other environments, (Jones, Harmon, & Lowther, 2002) we are writing here specifically to higher education. We chose higher education as an example for a number of reasons. One, it is an environment that we work in and understand. Two, it is an environment that is often imitated in other educational institutions. We feel that much of what we say could apply to any educational system, but because of space we'll limit our discussion to a university environment.

Defining the mission

To begin, we focus not on student learning, but on the mission of the institution, whatever it may be. All components of the system should work together to promote this mission. Student learning may represent only one part of it. We divide our model into four primary components, three of which are based on the common faculty perspective of the mission, namely **teaching**, **research** and **service**, supplemented by the fourth factor, **management**.

Teaching

The teaching component includes everything having to do with students, ranging from public relations, which might include such things as athletic teams, to on-campus housing, dining, and transportation systems. We believe that we can capture the complexity of this component with three primary elements. (See Table 1) Note that as with all other pieces of our system, activities within one component often overlap with other components.

Table 1. Elements of the teaching component

Element	Definitions
Student Recruitment	Deals with attracting students to the university. Impacts student services, quality of academic programs, types of athletic programs and other factors which may influence a student's decision to attend a university.
Student Retention	Keeping students enrolled in the university. Deals with issues such as campus life, academic assistance, and generally keeping the quality of the student experience high.
Student Matriculation	Ensuring that students progress and graduate in a timely fashion. Deals with access to classes and curriculums that are accessible and possible to finish in a

	reasonable amount of time.

Research

At many universities the research component may be tacitly viewed as the most important component of the system. Even at primarily teaching institutions, tenure and promotion decisions may rest significantly upon research (Boyer, 1997). The degree to which research is seen as a driving force at a university will vary considerably depending upon the institution's mission and goals. However, research will retain a prominent role in the academic community, and the best researchers will accumulate the most prestige and resources. Table 2 defines major elements of the research component.

Table 2. Elements of the Research component

Element	Definitions
Research Funding	Identifying funding sources, writing and obtaining grants. Also includes administration of grants and any profits realized from research.
Research Investigation	Defining and conducting research. The establishment and execution of a productive research agenda.
Research Dissemination	Making public the results of research through journals, conferences, and increasingly, the WWW.

Service

Service is generally the least rewarded of university tasks but ironically often seems to require the most time. Typically speaking, service happens inside the university, through such outlets as faculty governance, and outside of the university as outreach to the local community or to your community of professionals. Table 3 illustrates the two typical types of university service.

Table 3. Elements of the Service component

Element	Definitions
Governance	Participating in the self-governing process by serving on such bodies as departmental committees or the University senate.
Outreach	Service to one's profession or community. This may include such things as holding offices in professional organizations, serving as editors for journals, or volunteering time for professionally related community service.

Management

The fourth major component of our system is often the least regarded by faculty and students because it appears to have little direct impact on the teaching and learning. However, management serves to insure that the proper resources are available and are applied to the efficient functioning of the other components. Management can be the glue that holds the rest of the system together. Major elements of the management component are listed in table 4.

Table 4. Elements of the management component.

Element	Definitions
Faculty & staff recruitment & retention	Locating and keeping qualified personnel. Includes developing and implementing attractive compensation packages. Impacts the institution's reputation.
Logistical operations	The day-to-day functioning of a university. Everything from ordering the right books in the bookstore to making sure the trash gets emptied.
Program Evaluation	Making sure that the system itself is both appropriate and working correctly.
Finance	Finance is an aspect of the management component includes such things as budget, publicity, and alumni relations. Budget is at its most basic, the acquisition and distribution of funds (i.e.

	working with legislatures and donors) and managing tuition, fees, and salaries. Since publicity is usually considered as goodwill and has financial value we include it here. Publicity would include everything from University logos to PR campaigns. Alumni relations involve maintaining contacts with past graduates of the university for purposes of maintaining the reputation of the institution and in attracting donations.

We propose these areas as an example of the major components of an educational system. Other aspects of the system, such as stakeholders and the interactions among the components are beyond the scope of this paper. While we realize that we have not captured every element of every component, we do feel that these are representative and give us a starting place for looking at how WBI might impact the educational system. However before we look at its impact on the system, we must first look at how the Web might be used within the system.

Five Levels of Web Use

When faced with the prospect or requirement or of using the Web in education, many people assume that they are being asked to create an online environment that will be a stand-alone, self-sustaining educational product. While this may be the goal of some environments, it need not be the goal of all. Harmon and Jones (1999) suggest five levels of use of the Web common in schools, colleges, and corporations. These levels represent a continuum from basic occasional use to advanced continual use. We feel that these levels go a long way towards helping stakeholders understand how the Web might be used in an education or training setting. Each level provides for particular uses and classifications of interaction between the students and teachers, and between the humans and the technology. Table Five defines and summarizes each of the levels.

Table 5. Levels of WWW use in education. From Harmon and Jones (1999).

Level Of Web Use	**Description**
Level 0 : No Web Use	The default level. Implies no Web use at all.
Level 1 : Informational	Providing relatively stable information to the student typically consisting of instructor placed items such as the syllabus, course schedules, and contact information. This sort of information is easily created by the instructor or an assistant, requires little or no daily maintenance, and takes up minimal space and bandwidth.
Level 2 : Supplemental	Provides course content information for the learner. May consist of the instructor placed course notes and other handouts. A typical example would be a PowerPoint presentation saved as an HTML document and placed on the Web for students to review later.
Level 3 : Essential	The student cannot be a productive member of the class without regular Web access to the course. At this level the student obtains most, if not all of the written course content information from the Web.
Level 4 : Communal	Classes meet both face-to-face and on-line. Course content may be provided in an on-line environment or in a traditional classroom environment. Ideally, students generate much of the course content themselves.
Level 5 : Immersive	All of the course content and course interactions occur on-line. Does not refer to the more traditional idea of distance learning. Instead, this level should be seen as a sophisticated, constructivist virtual learning community.

It is our position that these levels can help any organization define how it plans to use the Web in education. Knowing at which level you are working will help you understand how your work can affect the entire educational system. To illustrate this, we propose a model for considering systemic issues in higher education as they relate to WBI.

The Model

To illustrate our proposed method for accounting for all systemic issues within higher education as it relates to WBI, we offer the model shown in Figure 1. The model can be read by taking each component of a higher education system, teaching (T), research (R), service (S), and management (M) and filtering it through the five levels of WBI, represented numerically. It is possible to take a single component of the system and fun it through all levels or a single level. Likewise, the entire system can be run through a single level or through all levels collectively.

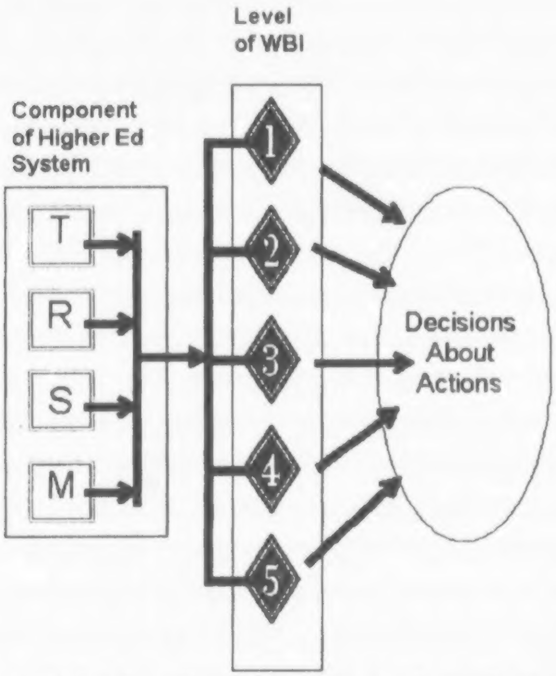

Figure 1. A model used to address Higher Education System Components as they relate to WBI.

To further explain how the model might be used, we will take each component of a higher education system and discuss it as it relates to each of the five levels of WBI, excluding Level 0. It should be noted that we would recommend a careful analysis of your individual environment. What we provide in the following pages is a generic discussion of issues in a higher education system as they relate specifically to WBI.

Level 1: Informational Web Use

The easiest level to reach, informational use of the Web may make the greatest impact on the Management component. Teaching itself may not be impacted greatly, but student's decisions on courses may. This level involves merely providing basic information to stakeholders via the Web

Teaching

Students today are thought of as consumers. Before they spend money on a class, or make a decision on a degree program, they may do considerable research. While putting a syllabus online may not impact instruction much, it will impact access to course information. This may provide better visibility to low enrollment classes or provide general publicity for a particular degree program. It may also impact faculty time and teaching expenses. Because the course syllabus is online, faculty do not have to spend as much time answering questions about classes to prospective students, or students may have more focused questions for the faculty member.

Research

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At this level, research may not be impacted greatly for the faculty member, but institutional research could have a field day. Data could be tracked on the relationship of access to syllabi to course enrollment and course evaluations. This is the kind of data that can help justify technical and support positions as well as capital upgrades to aging computing infrastructure. In addition, the university may wish to provide an online listing of faculty research interests, perhaps thereby generating some research opportunities, fostering collaborations, or providing assistance in research funding.

Service

While level 1 may impact committee work slightly (i.e. in terms of organizational charts and committee memberships placed online), the greatest impact on service at this level may come to faculty who specialize in technology. Technology faculty, (i.e. faculty in Instructional Technology, Information Science, or Computer Science), are often asked to take on the responsibility of creating and maintaining programmatic Web pages. The danger in this is that technology faculty are typically in academic units and not service units. Technology faculty can no more be expected to do other peoples Web pages for them than the accounting faculty could be expected to do everybody's taxes. Having the expertise does not mean that you have the time or inclination. If all faculty units would be required to do this as part of their service requirements, then their contracts should be evaluated to make sure that proper consideration is made for this work during tenure, promotion, and merit decisions.

Management

Making full use of the WWW in higher education will improve the university's goodwill or public image. At the time of this writing, any institution that makes it an institutional priority to have every course syllabus online could be seen as a leader in technology. As it becomes more convenient for current and prospective students to locate course information and make better-informed decisions about classes and degree programs the reputation of the university grows. With it grows enrollment, tuition dollars, and funding. But this level may be more difficult to achieve than some think. For example, at one large urban institution that we know of, there are 1,155 undergraduate classes and 1,105 graduate classes listed in the respective catalogs. To put all course syllabi on line, somebody must make sure that all of these syllabi are found, approved, and posted, not to mention updated as needed. This is a daunting task regardless of whether the responsibility is localized within a department or centralized by an outside office. Even though Level 1 is the easiest to achieve from a technical standpoint, it would still require much effort from a planning standpoint.

At Level 1, institutions must make critical and defining decisions about intellectual property and faculty load. Professors often teach classes focusing on their research, so a particular course may rely heavily on a particular person being there to teach it. As more information becomes public an important question must be answered: Who owns the course? Does the university own it because the university employed Professor Smith, or does Professor Smith own it as intellectual property? Putting materials online is not something most people have scheduled time for in their careers. If a faculty member makes the time, should they be compensated for doing this? If it is required of faculty to put course materials on line, should they be given reduced teaching loads? Should they be paid more money? Should a faculty member be paid royalties if the university continues to use the material after the professor leaves? These are critical questions that will need to be addressed.

Level 2: Supplemental Web Use

Supplemental Web use appears to make its greatest impact on actual classroom issues today. These classroom issues in turn impact the educational system in a variety of ways.

Teaching

The most common use of supplemental Web use is putting course notes and handouts on line. At this level the course schedule, which we distinguish here from the syllabus, will go online as well. One advantage of putting the schedule on line is that courses may change with the needs of the students. Course scheduling changes can be made and posted on a weekly basis. This will require more planning on the part of the instructor, and regular access by the students.

Many faculty are taking course handouts, such as Power Point slides, and placing them online as course notes or handouts to be reviewed later. However, a surprise to some people is that once students get the handouts they stop having a reason to come to class. Rightly or wrongly, lecture notes are often seen as the sole course content. Historically students go to class to get information they will need to pass tests on didactic content. If that didactic content is going to be placed on line, then they may indeed have few reasons to go to class unless the nature of the class changes. So at its most basic point, Supplemental Web use, perhaps more than any, will make the greatest impact on what will happen inside the physical classroom.

As a professor, if I no longer give lectures on a daily basis, what do I do? If the students no longer take notes, what do they do? Obviously this does not sound the death knell for classroom instruction or even the lecture. What it might do is breath new life into the classroom. Good teaching is not merely good public speaking. Good teaching is abo providing opportunities for students to become engaged in the learning process (Jonnassen, 1996).

Research

The biggest impact on research at the supplemental level is in dissemination. Researchers can post their preliminary results online and get immediate feedback from their peers. They can access their peers' findings that may affect their own work without having to wait months or even years before seeing them in a journal. Indeed, it is for these sorts of activities that the Web as initially created. (Crossman, 1997) Of course this easy access also removes the safety net of the referring process creating its own set of problems.

In addition, any change in the amount of time faculty spend teaching will have a direct impact on the amount of research and publishing they can do. While certain faculty may be able to use their classes as research settings, clearly all will not. Faculty who make the effort to work on their teaching are rarely rewarded for it (Boyer, 1997). But teaching is a significant type of scholarship, and one that should be treated as such (Boyer, 1997). University tenure committees must begin to recognize this and reward it not only as good teaching, but as good scholarship as well.

Service

If what we know as "traditional" classes change, then we can expect growing pains as this change takes place. If class formats begin to change, then institutions can expect successes at some points, and dismal failures at others. As faculty learn to teach differently, students will need to learn to learn differently. Changes in structure will nearly always be met with resistance initially (Rogers, 1983). At the service component, expect greater time spent in grade appeals. As faculty spend more time working on teaching, expect appeals on tenure decisions. The self-governance function itself may become more open to scrutiny as meeting agendas and minutes are published online All of this will impact the amount of university service done through self-governance.

Management

In the management component, this level will ultimately be championed if for no other reason than to save printing and copying costs. Freeing up money from departmental photocopying alone may be a tremendous financial boon. However, the administration will need to be tolerant of experimentation. Teaching evaluations may be poor for a period of time as faculty learn to teach differently, and students strive to understand a shift in the focus of the classroom experience. However, the change may bring the university greater recognition and ultimately better faculty, more students, and increased funding.

Level 3: Essential Web Use

As far as teaching and learning goes, putting course information on the Web at level 3 makes two significant assumptions: (1) Faculty and students have appropriate computing and internet access (2) Faculty and students have the requisite skills or support to use the Web. At many universities, these two assumptions are far from being realities.

Teaching

Obviously if the student needs Web access to be a contributing member of the class then the student will need Web skills. The question then becomes where and when does the student get these skills? There have been arguments made that newer students may bring these skills to campus with them. If not, then the university may need to rethink the core curriculum for new students. Freshmen are taught how to write and how to read critically, through "101" courses. Perhaps information technology literacy should also become a "101" course for students who do not possess these skills. At Level 3, we will very definitely encounter the issues of technology haves and have nots (Trotter, 1996). But students are not the only ones who suffer from poorly developed computer skills. Many faculty do not have adequate equipment in their offices, let alone the skills to produce essential materials.

Research

As with Level 2, teaching should be seen here as a type of scholarship, one that can be measured against particular criteria to ensure that the same rigor that is applied to the teaching process that is applied to the referee process (Boyer, 1997). Faculty may begin to publish research results solely in on-line refereed journals. Promotion and tenure committees may need to be educated as to the value of these sorts of research outlets, and to help them tell the difference between an on-line journal, and simply a paper that has been posted on-line. While I might be able to publish on-line at will, a posted paper is quite different than a published paper.

Service

This level also impacts the service components as well. For with new teaching strategies there will also be new policies and committees. The administration will need to form new committees and new mechanisms for dealing with information from these committees. Existing committees may find more work for themselves as well. Grade appeals are likely to be common for a period of time as faculty and students work towards understanding new strategies. Additionally, the faculty reward structure may need to be revisited. The business of putting education on line is more than simply converting syllabi and handouts to HTML formats. It will involve a comprehensive look at the way that students study and teachers teach. There will be new excuses to deal with (the server ate my homework?) and new ways of meeting with students (such as online office hours). The copy and paste commands, along with copious online term paper sites (i.e.. http://homeworksucks.com) have made plagiarism much easier. Faculty will need support and release time to do the job well. Students will need time and comprehensive information regarding what the changed expectations are. Finding both support and time may be difficult at many institutions.

In addition, in the professional service element, faculty may spend more time working for their professional organization virtually. Indeed, annual conferences may begin to occur solely online, freeing up time and travel money. However as time increases so does the amount of work required. Faculty my find themselves stretched thinner and thinner as more organizations seek their aid in online endeavors.

Management

Providing for these assumptions will require significant attention from the Management component of the system. At the Management component, this will make its most significant impact in the element of faculty and staff recruitment and Finance. In order to use the Web at level 3, the institution must make a commitment to a faculty and staff that can manage the technology. It is common knowledge that at many institutions there are faculty who are not going to make any changes in the way that they teach. Some institutions are relying on attrition and aggressive faculty training and support to move their institution into a technology using institution. Moreover, the increased burden on the network infrastructure that essential Web use entails may overwhelm some systems. Management will have to work and plan carefully to ensure that university computing resources can meet the demand.

Level 4: Communal Web Use

At the most basic level, Level 4 will need to change the expectations of students and faculty. If classes meet both face to face and on line, then this may impact logistical operations under the management component.

Teaching

Learning to teach online is quite an experience. At this level faculty need not only help in putting information on line, but help in managing the environment as well. Students begin to generate some of the course content themselves requiring faculty to evaluate new content and students to take responsibility for their own learning. This level may require the most fundamental shift in faculties and students mind-sets.

Research

Faculty may begin richer and more frequent collaborations with other researchers at this level of Web use. Distance becomes important only as a function of time of day. Researchers can begin to undertake projects of a scope undreamed of before. Consider for example efforts to crack cryptographic codes that use idle computing time on millions of desktop computers worldwide. Thanks to the Web (and internet) researchers can now do for an insignificant fraction of the cost and time what before would have taken supercomputers working thousands of hours and costing millions of dollars. Massive and convenient collaboration opens the door to more productive research in all fields.

Combining research and teaching becomes possible for a number of faculty. Education faculty may certainly conduct research on the benefits and limits of WBI (Reeves & Reeves, 1997), but other faculty, particularly those in the social sciences, may find research opportunities as well. Special educators may look at the benefits of WBI for students with special needs (Holzberg, 1996). Sociologists may look at the development of online relationships. Information scientists may develop and test new theories and devices, and other scholars can find outlets here as well. The biggest concern here is not that you can do research with your teaching, but rather that within the existing system you get credit for doing the things that advance the mission of the institution. Again we point to Boyer (1997) as having much to say on this subject.

Service

Meetings may now begin to take place entirely online. If nothing else, the onerous task of scheduling meetings will be eased at this level through the use of asynchronous work. Further, records of meetings will be highly detailed and accurate.

Management

The management component of the system can benefit from the use of the WWW at this level. Classes typically scheduled weekly in a room may not need the room every week. Depending on how classes are scheduled, it may be possible to teach two or more classes in the same room on the same night at the same time. This could be a tremendous boon for high use classrooms such as computer labs. Other benefits are just as real if less obvious. Georgia State University is actively encouraging faculty to hold classes online as part of an effort to reduce pollution from traffic in the City of Atlanta.

Communal Web use may also change the way students view schedules and classes. Many students don't feel comfortable with distance education, but they still live too far from campus to drive to every class meeting. Online classes may mean less driving time for students, which in turn means greater convenience for non-traditional students, which in turn provides the university with a reputation of supporting non-traditional students. These can be good things. As fathers of young children, the authors have appreciated the flexibility of conducting classes online from home. It means that at the very least we can be there to say goodnight after a long graduate class. Students also appreciate this flexibility. However most universities have contact hour requirements that state (roughly) that the student and teacher must be in the same room for a set number of hours over the period of the semester. Strict interpretations of existing contact hour requirements will make level 4 use impossible and mean that faculty and students cannot take advantage of this level of Web use.

In addition, as classes begin to move entirely online, the whole issue of what comprises a university begins to change. No longer is a university a place. Far from the Ivory Towers in isolated campuses of yore, universities will be thrust in among all of the other unwashed data on the net. Traditional rivalries and competitors may be replaced with competitors from across the country or around the world. Management will have to carefully consider market segments and demographics in much the same way broadcasting networks do now.

Level 5: Immersive Web Use

This level is steeped in the constructivist paradigm. In it, faculty, staff and students work to assist each other as they approach their respective tasks individually. Socially constructed knowledge exists here, but is secondary to individual constructions.

Teaching

At level five students and teachers interact with each other and directly with the knowledge base. The classroom becomes a true learning community in which knowledge is acquired, created and distributed on an egalitarian basis. The faculty member becomes more of a mentor than an instructor and students and faculty contribute to the literature in a field as well as learn from it. Naturally, this level is best suited to more advanced students and courses.

Though it may seem counter intuitive, the more students a course has, the lower the level of WBI that is appropriate. A fully immersive WBI environment as described in level 5 requires significantly more preparation time and classroom management time for the instructor than a traditional course. In our experience, a large part of this time comes from interacting with individual students. We believe that a single instructor cannot manage more than 10 to 20 students in this type of environment. For every additional 10 to 20 students the instructor should have some sort of teaching assistance. On the other hand, for courses with hundreds of students it makes more sense to distribute as much information as possible on-line. Therefore, for large numbers of students levels 1,2, and 3 are indicated. But levels four and five, in which more interaction is required, should be reserved for smaller classes. This is often times a struggle as you begin to think about implementing Web-based instruction.

Research

Research becomes more integrated with teaching as students as well as faculty begin publishing scholarly work online. Teaching at this level may well follow the conservatory method or that of a hard science research group, whose learning comes in the context of carrying out a research agenda.

Service

Service at this level is conducted entirely online. Virtual meetings and telecommuting are the rule rather than the exception. Virtual "town meetings" may take the place of some committee work where the entire university community participates in discussion of and action on an issue. There is a danger here of grid locked chaos, but the example of the governance of the internet itself suggests that immersive service can work quite well.

Management

The educational system may change strikingly at Level 5. There are organizations, and entire institutions emerging that do nothing but Immersive Web use (The Western Governors University, Nova, The University of Phoenix). In this case, the system itself will evolve around the particular needs and particulars of the university. However, if a traditional university begins to do this type of instruction, then many elements will be impacted. Course evaluations will need to be reconsidered to deal with a student body at a distance. Office hour requirements may need to be rethought to capture the nature of a new kind of student interaction.

This decision will impact the management of the institution significantly. Administrators who are pressed for classroom space and the need to generate more tuition related dollars often encourage faculty to take more students in on-line environments. Administrators need to understand the nature of the environment so that they might help make better policy.

Conclusion

Too often in the history of educational technologies has innovation been carried on in a piecemeal and haphazard fashion. Many creative ideas have been postponed or abandoned altogether, not because they were bad or unworkable, but because they were implemented in ways that at best made success questionable, and at worst guaranteed failure. Web-based education will not go away. It has gained too much momentum; it has reached Rogers' (1983) critical mass. It may founder in higher education for quite some time before it is embraced fully and used effectively as a teaching and learning tool. Or it may, on the other hand, revolutionize the business of higher education. It may enable faculty and students to embrace new methodologies of learning and instruction and make possible rapid, efficient, and effective learning environments of a sort never seen before.

It will probably do both. Some institutions will be incredibly successful at adopting Web-based instruction. Some institutions will be dismal failures. We believe the difference between them will be the manner in which they go about that adoption. Those organizations that undertake the adoption of Web-based instruction in a systematic and systemic fashion stand a good chance of becoming the premier institutions of the next few decades. They will consider the impact of Web-based instruction in all areas. They will acknowledge that Web-based instruction means different things to different people, that there are levels of WBI. They will probably not move as a whole from one level in our continuum to the next. Instead, different parts of an institution will be at different levels of the continuum at different times. It is likely that some parts of an institution will move down levels rather than up levels. This could occur as they experience disenchantment with the Web or technical frustration. Successful institutions will on average, we believe, continue to move up the continuum toward immersive Web use. Higher education in this country will eventually take place predominantly on the Web. It may take some time, but we academics are not easily discouraged. Instructors who wish to teach otherwise may one day have to do it in secret.

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WEB-Folio: INTASC Principles to Danielson's Framework

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ABSTRACT

Based upon the need for assessment of teachers, both pre-service and in-service we are in the processes of modifying all education courses to include reference to and use of Danielson Framework linked to current structure, which used INTASC Principles. Adaptation of our standards for assessment to better address the assessment parameters of Danielson's Framework is being done through a visual presentation. By using Inspiration to design the flow chart, and construction of a WEB-Folio template we are better able to show how it may serve as the assessment tool. Our timeline began with inclusion of INTASC Principles during our NCATE review and has continued to be a primary tool for student teacher observation. As we adapt to the use of the Framework, in preparation for utilization in Fall 2001, courses are being modified, students being acquainted with the domains, and a phase in plan being developed that allows for adjustment and absorption by both faculty and students. This presentation will deal with our adaptation, the basic frameworks domains, and how we designed the final Web-Folio to work for us in this assessment.

Background of the Study

Throughout the United States today, many teacher education programs and school systems are addressing the growing need of ways for assessing pre-service teachers academic performance. Many colleges have adopted some form of statewide and or national educational standards for assessment. The Commission, National Commission on Teaching and America's Future (NCTAF) prefers to use the word *assessment* because the word *test* evokes an image of simple paper-and –pencil examinations. The word assessment encompasses paper-and-pencil tests, portfolios containing examples of work, videotapes, and observations." (Spring, 29-30) For the past six years, Columbus State University has utilized many forms of assessment models to measure academic performance, teaching practice and the teaching knowledge of pre -service teachers. These assessment models include: (1). Interstate New Teacher Assessment and Support Consortium (INTASC) and (2) the Educational Testing Service's PRAXIS I & II exams. Following this a framework was "developed by Charlotte Danielson, who worked at the Educational Testing Service on both the PRAXIS III and national board standards and assessments. Her framework comprises 22 different teaching components organized into four teaching domains, and thus provides a rich, comprehensive description of good teaching practice. In addition, the ETS has developed a set of instruments that districts can use to assess an individual teacher's practice to four different levels of performance." http://www.edweek.org/ew/1999/41odden.h18

One of the earlier efforts was the production of a template utilizing Digital Chisel because of its availability in both Macintosh and PC formats. With the introduction of HyperStudio for PC, the template was redesigned for that software. Students were instructed in the use of the technology to modify these templates. The equally acquired documentation of skills and knowledge gained in the program as they met the INTASC Principles and state standards. As a continued effort in this process, the College of Education at Columbus State University conducted some research to identify the most valid, reliable and salient research findings on assessment models for measuring student's academic performance. Realizing that tangible products representing the student work would be an asset in evaluating the mastery of professional skills in teaching, the use of portfolios was investigated and determined to be one means of better incorporating examples into the process.

The term portfolio was not new, and certainly is a common form of assessment. The major distinction would be the nature of the portfolio. As part of this ongoing assessment development, research was conducted on the differences and similarities of paper, electronic, and web-based. From a basic understanding, it became quite evident that the advantage of not having to carry boxes of print materials, store disks, and maintain files, that web-based is the most attractive alternative. This research will be implemented in both revised pre-service and in-service program.

We are told, "Assessment is education's new apple pie issue. Everyone supports efforts to improve education; and everyone seems to believe more assessment will help improve education. Green & Smyser (1996) believe that "it's just grand that many people in so many elected and administrative offices support assessment." They went further to discuss the complexity of assessment. They emphasized that "there is, however, one little problem: getting all these individuals to agree on *how* and *what* to assess and *how to use the data*. They all agree about the *need* for more assessment, Unfortunately, the devil is in the details." (Green, K. p 62)

Implementation process of MAP at Columbus State University

The structure of the ten INTASC Principles served as a well-rounded guide to the development of professional educators, but did not provide distinctive components upon which to assess mastery of the skills of teaching. Thus, another barrage of search was undertaken to identify a tool to link our existing evaluation of INTASC Principles to deeper, more easily measurable elements of the pedagogical process. As a result of the research findings a group of faculty members were sent to Vermont to attend a workshop on Danielson Framework. These colleagues became known as the "Vermont Five". Following the guidelines in the framework, they stressed the "view of the characteristics that underlie all effective teaching is the "Framework for Teaching," developed as part of the Praxis Series: Professional Assessments for Beginning Teachers. According to the Praxis framework, a teacher must be proficient in four domains: planning and preparation, structuring classroom environment, instruction, and professional responsibilities." (Parkay, 357) Four months later, all faculty members in the Department of Curriculum Education and student teachers/field experience supervisors attended a two-day workshop on Danielson's Framework. The Educator Preparation Faculty also in 2000-2001 made some adaptations to Danielson's Framework to reflect Columbus State University, College of Education (COE) Conceptual Framework. The adaptation, under the leadership of Dr. Virginia Causey, was dubbed the Model of Appropriate Practice (MAP). Thus the MAP puts into practice the principles of the COE Conceptual Framework.

Orientation of faculty to Danielson Framework

Following the adaptation of the Framework to become the Columbus State University, College of Education Model of Appropriate Practice (MAP), an orientation was planned. This consisted of an overview, two-day workshop, and evaluation workshop for use of appropriate software. The software, Pathwise, provided a method to help evaluate student teachers and teachers in the field "within these domains while taking into account individual, developmental, and cultural differences among students and differences among subjects." (Parkay, 357) Then MAP was addressed again as part of the back to school Teacher Planning Week in August 2001. The faculty also recommended that the MAP should be infused in all pre-service teacher education courses starting with EDUF 2215 – Introduction of Education - The American Educational Experience. As MAP began its implementation, faculty members were assigned the task to develop an understanding of Danielson's Framework, its relationship to INTASC, and a way that these might be evaluated within a web based tool for assessment.

Development of instructional model and student model

The need to provide a presentation, for the purpose of instruction in the WEB-Folio, was indicated by the faculty members. The decision to use PowerPoint for initial presentation and conversion to html (web-based materials) was made based upon (1) availability, (2) familiarity to students (3) adaptability. We did research on available software according to cost, mastery of skills, and general availability. Having used Digital Chisel, HyperStudio, PowerPoint, Macromedia, Astound, it was our decision that the best, most time and cost efficient approach would be to keep it simple (KISS). This way, as our students' access and skills improved, it would be easy to upgrade the folios, and of course, any student will be free to use WEB-CT, FrontPage, etc. as they so choose. We only require that they (1) provide us access, and (2) address the Domain elements as proposed in the Guide and MAP publications. Once the template design had been developed, it was easy to see that taking the student template and filling in the blanks was the easiest method of providing for instructional needs. As the utilization of standards is a good way to provide a framework for education, they contribute to ensuring accountability and verifiable results. Students could have a professor elaborate on each Domain, the specific expectations for collection of "artifacts" and methods of inclusion, and retain a copy for use as a guide that supported the rubric provided for grading. The blank template, which included a frame for each Domain and for each subheading was designed. Upon completion it is to be mounted to a web site for downloading, copied to disks, and revision. The requested data to be included set the level for the standard to be met. Thus, we set our "High and clearly articulated standards for what children should know and learn (to) help teachers to become better educators and help students become better learners." (Paige, 8).

Presentation to faculty

"...teachers must be involved. The history of efforts to bring innovations into education documents the critical role of teacher involvement at each step along the way. If the assessment movement is to be successful, it must convince teachers that the intent of assessment is to provide feedback to the student, to parents, and to teachers about student learning. Assessment will fail if it becomes a punitive measure against teachers." (Green, K. p. 63) During workshops held as part of the orientation to the College of Education Model of Appropriate Practices (MAP), it was announced that Drs. Kuforiji and Riggsby had been given the assignment to develop a WEB-Folio for use in assessment of our students. As fall semester began, the Teacher Planning Week activities included a slot for us to share the process and template we had developed during four months of work. At this time, a sample PowerPoint presentation was shared that provides the faculty member with a means to show the students what is expected with samples for each area of the Domains, and a template, which provides the student with a master for inclusion of work samples. These were uploaded to a Website and a password given to them so that they might have access to updates, new materials, and other things we would like to share about this product.

Orientation in class

Presentation of the model initially takes place during EDUF 2215: The American Educational Experience orientation session. This session the students are given an overview of the nature of the assessment, based on samples of work (artifacts), and the tool for exhibiting these (WEB-Folio). There is a demonstration of the PowerPoint template, which has the frames filled in with sample ideas of what to include. The specific areas that are to be completed at the end of this class are stressed. In EDUF 2215, the student must complete a basic resume, with a frame for each of the areas, such as Personal Information, Education, Work History, Professional Activities, Community Service, Honors, and References; and fifty percent of Domain 1, which deals with Planning and Preparation for Teaching. A WEB-Folio Guide has been prepared to present this information in printed format. This guide is available on the class web site for download.

Semester of field-testing

Currently (Fall semester 2001) we are engaged in the initial test of our template and instructions. The template, at this point, is one in PowerPoint. This was selected as a commonly recognized format that would be less threatening as an initial format, as well as one that is easily converted to html. Sophistication will follow as the students take advantage of the program to study higher technology skills. At this stage, we are more concerned with ability to understand the nature of the assessment program, what one is trying to assess, and how to identify representative "artifacts" to select for inclusion. The *Guide to the WEB-Folio* is presented to the students in teacher preparation, but we find that comprehension of the written word may be a challenge. A rubric developed for grading the product, the time line for development, and sample ideas for inclusion are also provided for faculty and student guidance. Basically, the very nature of this being a NEW idea to students makes it appear to be a difficult assignment. We are finding that five minutes of direct question and answer sends the student off satisfied with the knowledge of what is expected.

Identification of Domains for each course in Education

Each professor, whether full-time or part time is encouraged to identify the parts of the Domains that are applicable to the course being taught. Hopefully, program coordinators will help all those individuals teaching a specific course to come to an agreement of the common elements from the Framework (MAP). The development of a form for determining the elements of each of the four domains was presented to all professors within the College of Education for each course being taught. Upon completion of these, the report will be correlated for each major in order to provide a flow chart enabling the student to know what is expected for each course as part of the WEB-Folio. Upon establishment of the template on the Web, students and faculty may freely begin constructing a personalized format of the assessment tool. Each faculty member will be aware of the point in time when the class must include specified elements of the Four Domains of CSU MAP. The students will have gradually become comfortable with updating entries and adding new frames for their ever-expanding catalog of "artifacts" to support the criteria for evaluation. The Faculty will be prepared to check the elements relative to the specific course and notations of needs for inclusion or improvement before permitting the student to continue in the program. As the process is perfected, files will be maintained and student assessment becomes an incremental task shared by all faculty members in the program.

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Links to Danielson

http://www.ascd.org/readingroom/books/196074.html
Association for Supervision and Curriculum Development
http://www.ascd.org/readingroom/books/danielson96book.html#chap1
Association for Supervision and Curriculum Development – sample
http://www.emu.edu/educ/mission.html
Eastern Mennonite University, Harrisonburg, VA
http://www.emu.edu/educ/mission.html#chart
Links for INTASC, Praxis III, and Danielson Framework

BEST COPY AVAILABLE

http://www.valdosta.edu/~alhines/
Sample of student portfolio.
http://www.wcer.wisc.edu/cpre/tcomp/research/standards/framework/
Framework for teaching project
http://www.mpls.k12.mn.us/staff/teacherportfolio/portfolio_Homepage1.html
Minneapolis New Teacher Portfolio site
http://www.ets.org/aboutets/news/00111502.html
Educational Testing Service news site
http://www.state.tn.us/education/frameval/index.html
Link to Tennessee assessment site

Search engines

http://www.comsearch.net/search_engine_directory.htm

Instructional Systems & Distance Education: Understanding the Implications

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Abstract

The design of instructional text is an important consideration when attempting to design a successful learning environment. With the rising involvement in online distance education, it is becoming even more important to adhere to good principles of text design. The purpose of this paper is to provide a framework of possible instructional systems design strategies and their associated tactics to use in an online environment based on research studies conducted on traditional paper-based materials. We argue that the focus on content, and particularly the focus on designing quality content should not be discouraged, but rather, we must consider it as a fundamental foundation for the development of other online components. The intellectual property of the faculty member, the content, the "text" as it is called in its fundamental sense should serve as the basis by which we ground our communication, our understanding, and our interactions in an online distance education course.

Introduction

The design of instructional text plays an important role in the field of Instructional Systems. It is through text which we receive many of our day-to-day messages, including simple things such as menus and memos, to more complex texts such as textbooks and articles. The increasing number of distance education courses is creating a new text medium through which individuals can interact. Many of the information learner's process come through the medium of text. In order for text to be in existence, authors must put forth their words of communication into a form, such as a book, article, memo, and now on-line courses, and the learner must interact with it. It may appear simple but much is going on between the time the author puts their content on paper and the learner attends to it, interacts with it, and processes it. What is occurring relates to a learner's text processing strategies (Duchastel, 1982). The text should not merely be a message from the author, but rather the message should be encompassed in a textual design which promotes learning.

Duchastel (1982) identifies the processes of attention, comprehension, and retention as crucial to the textual processing of a message. The learner must first be able to pay attention to a piece of text and sustain interest. The learner must then be able to understand what the author is trying to convey, and for ultimate effectiveness in the communication of a message, the learner will retain what they have learned. If we agree that these processes are vital to the communication of a textual message, then we can begin to speculate about strategies and tactics that authors can utilize to enhance the likelihood that each of the above processes would occur.

Where the conundrum occurs is in the medium of on-line distance education courses. There has been an abundance of research studies addressing text design variables in more traditional paper-based materials, but few studies have investigated the use of design strategies and tactics in an on-line distance education environment. In fact, some researchers argue that the capacity for the new technology to enhance learning quality is failing on-line courses (Duchastel, 1997). The only analyses of online courses have produced results indicating authors are simply creating electronic versions of their traditional print-based materials (Dehoney & Reeves, 1998). This paper provides an alternative way of viewing this discouraging environment of course quality and use of design strategies. We argue that creating an on-line course must begin with a fundamental examination of the "text". Regardless of the type of interaction strategies, communication environments, or activities planned in an on-line course, the content (which can be referred to as the text or the intellectual property of the faculty member who authored it) provides the essential foundation from which the interaction, communication, and collaboration activities can occur. The purpose of this paper is to provide a framework of possible instructional systems design strategies and their associated tactics based on research studies conducted on traditional paper-based materials. It is not the purpose to provide an exhaustive review of all possible design tactics that can be utilized in an on-line environment, but rather to stimulate interest in formulating basic research in the design of content in on-line environments.

In order to elicit optimal text processing as discussed by Duchastel (1982) above, he has grouped the various design tactics into three broad strategies: labeling, highlighting, and illustrating. Labeling strategies identify and summarize the facts, concepts, rules, principles, and procedures in the text. Highlighting strategies help the learner to focus on the material. The third strategy, illustrating, assist the learner with the functions of attention, comprehension, and retention. Each of these strategies and their associated tactics can help the author structure and organize content in such a way as to promote the acquisition, integration, comprehension, and application of the message being communicated. The next section will provide a sampling of possible tactics that can be utilized under each of the strategies identified by Duchastel (1982).

Instructional Strategies

This section will describe the three instructional strategies of labeling, highlighting, and illustrating. Within each of these strategies, specific tactics that would be most easily implemented in an on-line distance education medium will be identified. Although research in the area of instructional systems has primarily focused on the design of text-based materials, the increasing rise of on-line distance education courses provides an impetus for identifying which text-based variables could serve to enhance the quality of on-line materials. Once particular variables have been identified, research studies need to be conducted to determine the effectiveness and efficiency of these text-based variables in an on-line medium.

Labeling

The major design variables that can be utilized under the general category of labeling include headings, marginal notes, and embedded glossaries. The purpose of these tactics is to identify and summarize the content provided by the author. The content can be in the form of facts, concepts, rules, principles, and/or procedures. These tactics can serve to enhance learner attention, comprehension, and retention of the material at the lowest level of processing. These instructional tactics also tend to be fairly efficient. Labeling is often associated with the strategy of signaling which is defined as orienting the learner to the text through the use of various textual display tactics. The purpose of signaling/labeling is to help the learner identify the "structure, type, or function of content" (Jonassen & Kirschner, 1982, p. 124). Its purpose is to orient the learner to the text document and allow them to organize their attention and retrieval strategies to improve performance. In the following paragraphs, the use of headings, marginal notes, and embedded glossaries will be discussed.

Headings can be defined as a typographically and spatially distinct piece of text signifying the theme or content of the section following it. Headings have been shown to increase the general improvement of text memory (Lorch & Lorch, 1985). Even when a variety of different measures are used, such as cued recall summarization, or free recall, headings show improvement for memory (Dee-Lucas & DiVesta, 1980; Hartley & Trueman, 1985; Holley, Dansereau, Evans, Collins, Brooks, & Larson, 1981). Headings are a relatively efficient way to incorporate good instructional design in on-line courses.

The second labeling tactic, marginal notes, has received little research attention. Marginal notes are defined as a column alongside the content which both outlines the content and acts as a running summary. Duchastel and Chen (1980) also find marginal notes act as an "access structure" allowing the learner to identify the appropriate details from the overall text. Although they did not conduct an experimental student regarding marginal notes, Duchastel and Chen (1980) surveyed sixteen students and found that fifteen of them agreed that marginal notes were useful. Marginal notes, if used appropriately, can be an excellent addition to an on-line course. The only dilemma to is the necessity to avoid the use of frames in creating the marginal note column. Web sites using frames create extreme difficulties for individuals with disabilities who use screen readers.

The third labeling tactic is the use of an embedded glossary. Acting as a terminology marker, an embedded glossary is defined in this project as a tool which identifies difficult words and defines them. This tactic is fundamentally different from marginal notes, though, because it does not attempt to summarize any of the information learned up to a given point. It merely identifies a present word on the page and defines it so the learner is less involved in the terminology and more involved with the content. Although research has not investigated the effectiveness of embedded glossaries, the use of an embedded glossary is a relatively easy tactic to implement in an on-line course. The author of the course can simply identify difficult words in the text and hyperlink them to a page containing the definition.

Table 1 provides a brief overview of each of these tactics and additional ones, their purposes, and research literature that has examined them.

Table 1. Labeling Strategy Tactics

Tactic	**Purpose**	**Research Literature**
Headings	▪ Identify main points ▪ Enhance organization ▪ Increase retrieval ▪ Provide structure	▪ Doctorow, Wittrock, & Marks, 1978 ▪ Dee-Lucas & DiVesta, 1980 ▪ Hartley, Kenely, Owen, & Trueman, 1980 ▪ Holley, Dansereau, Evans, Collins, Brooks, & Larson, 1981 ▪ Lorch & Lorch, 1985, 1996 ▪ *Hartley & Trueman, 1985* ▪ *Wilhite, 1989*
Marginal Notes	▪ Identify and summarize main points ▪ Focus attention ▪ Increase retrieval and provide structure	▪ Duchastel & Chen, 1980
Embedded Glossary	▪ Identify and define key concepts ▪ Clarify text and enhance retrieval	▪ No literature found specifically addressing embedded glossaries
Chunking/ Spacing Text	▪ Enhance structure and organization ▪ Assists with organization and retrieval	▪ Miller, 1956 ▪ Frase & Schwartz, 1979 ▪ Wilson, Pfister, & Fleury, 1981

Highlighting

The major design tactics that can be utilized under the instructional strategy of highlighting include typographical cues, objectives, summaries, questions and advanced organizers. The purpose of these techniques is to highlight for the learner important content. These techniques can also organize the content for the reader, which will enhance their attention, comprehension, and retention of the content at a deeper level of processing than is provided by the labeling instructional strategy. Highlighting is related to the strategy of controlling defined as the utilization of textual display tactics to initiate different mental processing capabilities. The purpose is not only to signal the text but also to control the attention of the learner, and purposefully identify information that is important and requires the learner's focus. In the following paragraphs, the use of typographical cues, advanced organizers, and objectives will be discussed.

Typographical cues are a very cost-efficient method of improving the structure of a text document. Particularly with the use of bolding or italicizing, one can increase the readability of the text and increase the likelihood that the learner will extract the main points. Typographical cues are defined as a highlighted text word or fragment in the body of the text which serves to draw a learner's attention to the content surrounding it. Typographical cues have been studied extensively, and many studies have found the use of them to improve memory for the text word or fragment it is highlighting (Cashen & Leicht, 1970; Glynn & Divesta, 1979). One unresolved matter in experimental studies on typographical cues is the effect on the content which is not highlighted. Some have found that memory for text which was not highlighted to be unaffected (Foster, 1979) while others found it to inhibit recall (Glynn & Divesta, 1979). The importance of distinguishing among facts, concepts, and rules/principles may play a role in this particular contradiction. A possible explanation is typographical cues may need to be used on specific types of information. For example, they may be more appropriate to use on facts. Further research can help to clarify inconsistent results. Although bolding, italic izing, underlining, all caps, and color can be used to create typographical cues, the most cost efficient in developing an on-line course would be the use of bolding or italicizing. Underlining and words in color can often be confused with hyperlinked items.

The second major highlighting tactic to be discussed here is the use of advanced organizers. Advanced organizers are defined as a brief verbal statement providing a mechanism for the learner encoding process. This brief verbal statement contains no reference to the content in the document, but rather sets up the organizational features of the document to aid the learner's processing. As seen with some of the other mentioned text variables above, advance organizers have conflicting findings. Ausubel (1960), the pioneer of advance organizers, found in all of his studies that those groups with advanced organizers recalled more than that of the control group. Hartley and Davies (1976) after summarizing the results of many studies on advanced organizers found that the use of them does improve learning. Particularly for an on-line course where the learner is at a distance from the instructor, it is important to provide a clear understanding for the learner regarding the types of strategies and tactics utilized throughout the document. For example, if the author of a course decides to utilize typographical cues to symbolize important concepts by bolding them, the student should be made aware that bolded words symbolize concepts they need to make sure they understand. Advance organizers may even be useful for stimulating motivation because they serve to increase confidence (Keller, 1987) in what the learner is likely to expect within the content.

Objectives are defined as statements of what the learner should know and be able to answer questions about in the upcoming sections. Objectives are another area of contradictory study. Some experimental studies have found that learning is improved by the use of objectives (Rothkopf & Kaplan, 1972), while other studies have found the opposite finding (Jenkins & Deno, 1971). One possible explanation for the inconsistency in research results could be that the objectives in each study may have been written using incomparable models. Most instructional designers use Mager's (1975) model for writing behavioral objectives. This model stipulates that objectives should include the actual skill or behavior that the learner should be able to perform upon completion of the instruction, conditions under which the learning should occur, and the criteria for successful performance. The use of objectives is a cost efficient and if used appropriate, effective strategy to utilize in an on-line course.

Table 2 provides a brief overview of each of these tactics and additional ones, their purposes, and research literature that has examined them.

Table 2. Highlighting Strategy Tactics

Tactic	**Purpose**	**Research Literature**
Typographic Cues	▪ Focus attention on material ▪ Facilitate learning and retrieval of main points ▪ Enhance structure and organization	▪ Cashen & Leicht, 1970 ▪ Fowler & Baker, 1974 ▪ Glynn & Divesta, 1979 ▪ Foster, 1979 ▪ Hartley, Kenely, Owen, & Trueman, 1980 ▪ Nist & Hogrebe, 1987
Advanced Organizers	▪ Focus attention on document ▪ Facilitate learning and retrieval of main points ▪ Enhance structure and organization ▪ Provide learner a content-oriented summary to help learner focus on important points as they read through document	▪ Ausubel, 1960, 1962, 1963, 1968, 1978 ▪ Ausubel & Fitzgerald, 1961, 1962 ▪ Barnes & Clawson, 1975 ▪ Hartley & Davies, 1976 ▪ Luiten, A mes, & Ackerson, 1976 ▪ Mayer, 1979 ▪ Hartley & Trueman, 1982 ▪ Lorch & Lorch, 1985, 1996
Objectives	▪ Focus attention on material ▪ Facilitate learning and retrieval of main points ▪ Enhance structure and organization	▪ Rothkopf & Kaplan, 1972 ▪ Duchastel & Merrill, 1973 ▪ Duell, 1974 ▪ Hartley & Davies, 1976 ▪ Davies, 1976 ▪ Duchastel, 1979
Summaries	▪ Enhance focus/comprehension of material	▪ Newsom & Gaite, 1971 ▪ Hartley & Burnhill, 1978 ▪ Hartley, Goldie, & Steen, 1979 ▪ Reder & Anderson, 1980
Questions	▪ Enhance deeper level of processing	▪ Rickards & Denner, 1978

Illustrating

The strategy of illustrating tends to incorporate the least cost-efficient tactics. Tactics such as graphics and diagrams tend to cost additional money to develop but can increase the level of processing of particular content. Table 3 provides a brief overview of the tactics of graphics and diagrams/flowcharts/tables, their purposes, as well as research literature that has examined them.

Table 3. Illustrating Strategy Tactics

Tactic	**Purpose**	**Research Literature**
Graphics	▪ Provide additional assistance in	▪ Dwyer, 1968, 1972

	processing content ▪ Offer a visualization of textual description	▪ Hurt, 1987 ▪ Levie, 1987 ▪ Weidenmann, 1989
Diagrams/ Flowcharts/ Tables	▪ Offer a hierarchical or process orientation for content through visual representation	▪ Burnhill, Hartley, & Young, 1976 ▪ Richards & Johnson, 1980 ▪ Larkin & Simon, 1987

Conclusion

The framework of strategies and tactics provided offers a chance to reassess the way we view content in the online environment. Some authors believe that current and forward thinking should encourage a discouragement of the emphasis on content in the design process (Oliver, 1999) in favor of a focus on learning activities and learning supports. We argue that the focus on content, and particularly the focus on designing quality content should not be discouraged, but rather, we must consider it as a fundamental foundation for the development of other online components. The intellectual property of the faculty member, the content, the "text" as it is called in its fundamental sense should serve as the basis by which we ground our communication, our understanding, and our interactions in an online distance education course.

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Incorporating Academic Standards in Instructional Systems Design Process

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Abstract

Almost every state is "imposing" academic standards. Helping students to meet those standards is a key task for teachers, school administrations, as well as instructional systems designers. Thus, instructional designers in K-12 environments are facing the challenge of using appropriately and effectively academic standards in their instructional systems design process. This presentation offers some effective ways of handling academic standards in the instructional systems design process together with examples. It is hoped that this presentation will encourage experts in both academic standards and ISD to examine the role and influence of academic standards on ISD processes and the subsequent outcomes.

1. Introduction

Many states are "imposing" academic standards which need to be addressed in instructional systems design (ISD) process and incorporating academic standards effectively becomes a crucial skill for instructional designers in K-12. This presentation examines effective ways of incorporating academic standards in ISD process. Examples of how academic standards can guide and help ISD process will also be discussed. Another goal of this presentation is to encourage experts in both academic standards and ISD to examine the role and influence of academic standards on ISD processes and the subsequent outcomes.

2. Defining terms

Academic standards in this presentation will refer to the official documents from the national, state department of education or local educational commission that define what each student should know and do in a core set of subjects. They are academic targets for students, teachers and parents to meet. *Proposed Academic Standards for Science and Technology* by Pennsylvania Department of Education is an example of such state-defined academic standards.

Instructional Systems is better known as Educational Technology or Instructional Technology. It is defined as "the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning" (Seels & Richey, 1994, p.1, the AECT Definitions and Terminology Committee, 2000). Its ultimate purpose is to improve effectiveness and efficiency of human learning. Instructional systems design (ISD) in this article refers to the systematic process of planning instructional systems, specifically the process of analysis, design, development, implementation and evaluation of instructional programs.

3. Relationships between academic standards and instructional system design

Academic standards are constructed to give students a solid foundation in the basics and to provide consistent targets for students, teachers and parents. They allow schools to measure student achievement. They help parents, teachers, school administration and school districts follow the progress that students make from year to year. "Done right, aligned standards and assessments give us something that standards and curriculum objectives, by themselves, never delivered: the ability to see how well we are performing and how much we are improving." (Pennsylvania Department of Education, 2001. online: http://www.pde.psu.edu/standard/backgrnd.html)

The importance of academic standards has long been recognized in education. Studies related to academic standards range from the characteristics of good academic standards to their influence in facilitating educational reforms and students' achievements. Setting up good academic standards is important. However, how to help students to meet those standards are the real purposes. This is where the academic standards and ISD meet. According to the definition above, the ultimate purpose of ISD is to make the learning maximally effective and efficient. Therefore, in K-12 environments, the ultimate purpose of ISD is to help the students achieve those academic standards effectively and efficiently.

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4. Incorporating academic standards in instructional systems design

All the academic standards should be measurable, applicable and clearly written. When applying the academic standards in instructional systems design, they might not be so either because of standards themselves or the limits of resources available to apply them. The author summarizes the following ways to incorporate academic standards appropriately and effectively in ISD. They are to be discussed in the four aspects (1) systemic approach in incorporating academic standards, (2) academic standards as ISD guide, (3) flexible use of academic standards in ISD, and (4) moving beyond academic standards.

4.1. Systematic approach of incorporating academic standards

The systemic approach in ISD refers to the way in which instructional systems designer takes every aspect of ISD into consideration in order to produce effective instructional programs. It should be differentiated from systematical approach. The systematical approach is linear, step-by-step approach while the systemic is integrated, holistic approach in ISD efforts (Banathy, 1996).

A systemic approach in incorporating academic standards in ISD process should take following into considerations and balance between what should be done and what could be done:

- Which academic standards should be included in the ISD programs that can help the students most?
- Which academic standards should be included in the ISD programs that are in alignment with the project rationale and goals, and student and school needs?
- Which academic standards should be included in the ISD programs according to the availability of resources (personnel and financial resources, equipment and facilities resources, technical and content support, and time constraints, etc.)?
- How much academic standards should be included in the ISD programs according to the availability of resources (personnel and financial resources, equipment and facilities resources, technical and content support, and time constraints, etc.)?

The systemic approach ensures the effectiveness and efficiency of incorporating academic standards in ISD.

4.2. Academic standards as the ISD project guide

Academic standards can be used as ISD project guide. Instructional systems designers can refer to academic standards to establish ISD project rationale and project goals. This is especially true in writing grant proposal for ISD project. In analyzing phase of ISD, academic standards can provide guidance and references on specific learning objectives for the ISD program. This ensures that contents of ISD programs designed and developed are right on the target by defining what the students are supposed to learn and help them to learn well to meet the standards. In implementing and evaluating of ISD programs, the academic standards may also provide instructional systems designer with what to assess or basis for what to assess. Many academic standards can provide yardsticks for both summative and formative evaluation in the ISD programs. The rubrics or criteria for assessment can be directly developed from the academic standards. All these help to increase the validity of the assessments involved in ISD programs.

To use academic standards as a guide appropriately, it is always advisable for instructional systems designers to consulting with subject matter experts and the schoolteachers who are going to use the ISD programs eventually in their classrooms. It is very important to make sure that you have reached a consensus in explaining and understanding the specific academic standards that the ISD program is to include. Otherwise, there is no way for the teachers to use the ISD program effectively if it conflicted with their beliefs and understanding.

4.3. Flexible use of academic standards in ISD

Academic standards are important to instructional systems designers and how to incorporate them appropriately in ISD process is crucial for those work in K-12 environment. Academic standards provide general guidance in terms of learning content for ISD programs. However, in most of the cases, they cannot be directly used as learning objective for ISD programs. A competent instructional designer should be able to use academic standards flexibly.

There are three effective ways of using academic standards without comprising their quality and quantity. They are (1) deriving learning objectives for a single ISD program unit from multiple standards, (2) deriving learning objectives for multiple ISD program units from single standard, and (3) deriving learning objectives for multiple ISD program units from multiple standards.

1. For a single ISD program unit, the learning objectives can be derived from multiple standards. (Please see **Example 1: Multiple standards for a single ISD program unit.**)
2. The learning objectives for multiple ISD program units can be derived from a single academic standard. (Please see **Example 2: A single standard for multiple ISD program units.**)
3. The learning objectives for multiple ISD program units can be derived from multiple academic standards. Although none of the ISD program units fully covers a single academic standard, the multiple units cover all the targeted academic standards and may overlap. (Please see **Example 3: Multiple standards for multiple ISD program units.**)

4.4. Moving beyond academic standards

Academic standards should be the guide and references for ISD rather than the obstacles and constraints. A competent instructional systems designer should not only be able to use them flexibly but also be able move beyond academic standards in ISD. This can be done mainly in two ways. First, ISD should not only aim at accomplishing the target standards but also aim at preparing the learners to achieve higher academic standards. For example, in designing a lesson of biology for the 5th grade students, instructional system designer should not only consider the present learning target but also prepare the students to achieve those academic standards in their future study. Maybe you could find that some of the academic standards for the 6th grade students can be partially incorporated in your design for the 5th grade.

Another way of moving beyond the academic standards in ISD process is to integrate academic standards of different subjects into your ISD programs whenever possible. For example, in designing computer-assisted lesson of biology, the academic standards of science and technology can be easily integrated together. In developing a lesson of environment protection, the academic standards in writing can be integrated together. For instance, in **Example 1: Multiple standards for a single ISD program unit,** the learning objectives for ISD program are derived from academic standards for 4th grade students. The academic standards are from different subjects of study (Environment and Ecology, and writing) and for different grades (grade 4 and grade 5). The integration of academic standards from different areas of learning would foster the learners' development in all fields of studies.

5. Conclusion

For instructional systems designers in K-12 environments, academic standards mean a lot. "The program rationale must be based on the academic standards, otherwise, we will never get the grant." "We have to cover these standards as required by the grant." "Derive program objectives according to the academic standards and also remember to assess the learners according to them. We need a report on that." Like it or not, these are common statements and actual practices of ISD in the field of K-12. The practical ways mentioned above can help instructional systems designers in K-12 incorporate academic standards appropriately and effectively in ISD process and help more students meet their academic standards.

Also, it is hoped that this article would bring more experts both in the fields of academic standards and instructional systems design to study the effective and efficient ways of incorporating academic standards in ISD processes and their subsequent outcomes. It is obvious that the efforts of study academic standards in ISD process will benefit a lot both students and teachers in K-12 education.

Example 1: Multiple standards for a single ISD program unit

Multiple Academic Standards	Learning Objectives for a ISD Program Unit

Academic Standards for Environment and Ecology (Pennsylvania Department of Education, 2001) 4.9.4 Grade 4 ***A. Know that there are laws and regulations for the environment*** - *Identify local and state laws and regulations regarding the environment* - *Explaining how the recycling law impacts the school and home* - *Identify and describe the role of a local or state agency that deals with environmental laws and regulations*	**Lesson Objectives derived from the academic standards** *1. Given examples of environmental laws and regulations, the student will be able to categorize them correctly (85%) into three main categories (Air, Water, and Pesticides and other pollutants).* *2. Student will be able to discriminate correctly (95%) between recyclable and non-recyclable items in their daily life both at school and home.* *3. The student will be able to describe in writing the following roles of a local or state environmental agency that deals with environmental laws and regulations.* *a. Monitoring environment* *b. Environmental law enforcing* *c. Gathering and sharing information on environment*
Academic Standards for Environment and Ecology (Pennsylvania Department of Education, 2001) 4.2.4 Grade 4 ***D. Identify by products and their use of natural resources*** - *Identify those items that can be recycled and those that cannot*	
Academic Standards for Reading, Writing, Speaking, and Listening 1.4.5 Grade 5 ***B. Writing multi-paragraph informational pieces (e.g. essays, descriptions, letters, reports, instructions.)*** - *Include cause and effect.* - *Develop a problem and solution when appropriate to the topic* - *Use relevant graphics (e.g. maps, charts, graphs, tables, illustrations. Photographs).*	

Example 2: Single academic standard for multiple IDS program units

Single Academic Standard	**Learning Objectives for Multiple ISD Program Units**
Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001) 3.3.4 Grade 4 ***A. Know the similarities and differences of living things*** - *Identify life processes of living things (e.g. growth, digestion, react to environment).* - *Know that some organism have similar external characteristics (e.g. anatomical characteristics; appendages, types of covering, body segments) and that similarities and differences are related to environmental habitat.* - *Describe basic needs of plants and animals.*	**Objectives for Unit One** *1. Given an example of living animal or a plant that student are familiar with, students will be able to clearly describe its life process by using concepts of growth, digestion, and its external characteristics.*
	Objectives for Unit two *2. Students will be able to describe the basic needs of plants and animals and explain how living things are dependent on other things—both living and nonliving--in the environment for survival by using examples that they are familiar with*

Example 3: Multiple academic standards for multiple IDS program units

Multiple Academic Standards	**Learning Objectives for Multiple ISD Program Units**
Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001) 3.7.4. Grade 4 ***D. Use basic computer software.*** • *Applying operating system skills to perform basic computer tasks.* • *Apply basic word processing skills.* • *Identify and use simple graphic and presentation graphic materials generated by computer.* • *Apply specific instructional software*	**Objectives for Unit 1** *Given the category type of search engine, the students will be able to locate information needed to solve the given problems that are appropriate to their age by* • *Forming up appropriate questions* • *Identifying the key words to location information needed* • *Being selective (critical) towards information found online* • *Using the information founded to solve given problem* • *Using email format to communicate solutions*
Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001) 3.7.4. Grade 4 ***E. Identify basic computer communication systems.*** • *Apply a web browser.* • *Apply basic electronic mail functions.* • *Use online searches to answer age appropriate questions.*	**Objectives for Unit 2** *1. Given student a business web site, the students will be able to identify correctly the basic components web site including* • *URL* • *Site title and site content (Navigation bars, contact information)* • *Description of the company (Name, address, company logo and contact information)* • *Products and services* • *Date of site information updated* *2. Students will be able to use graphic designing principles to evaluate the site design in terms of* • *Easy to read* • *Layout of website* • *Consistency in graphic presentation*
	Objectives for Unit 3 *Given a web design template, student will be able to design a business site for advertising company products and services by following graphic principles in unit 2.*

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Using Developmental Research to Study One's Teaching of an Instructional Design Course

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Abstract

This five-year study of two instructors teaching a master's level instructional design course used developmental research to systematically examine a reflexive teaching approach. The reflexive teaching model is described. Eight data sources across six deliveries of the course were analyzed in terms of design decisions (i.e., the teaching model), model implementation, and model evaluation. Methodological issues of this developmental research study are discussed, including data management of evolving data sources, data analysis of teaching artifacts, and the balancing of teaching goals and research objectives. Guidelines for using developmental research to study one's teaching are summarized.

Developmental Research

We view developmental research as co-contributing to the development of educational interventions (models and other processes, courses, media/technology artifacts), as well as knowledge about this development in the form of design principles or frameworks. Developmental research uses a developmental cycle, consisting of design, development, implementation, and evaluation activities, to formally study these interventions over time. The intent of developmental research is partly pragmatic design, developing products or processes that are needed to serve human needs (Norman, 1993). The intent is also to learn from our design efforts, to formulate what we learn so that these principles and frameworks assist us in developing other interventions in different contexts.

Reeves (2000) reminds us that the aims of any research depend on the researcher's epistemological lens, which in turn influences the selection of one's research goals and research framework. For example, development goals differ from empirical goals. While empirical research is characterized by a researcher using research hypotheses and the testing of these hypotheses to refine existing theory, developmental research involves collaborators in the analysis of practical problems with the testing of designed solution in actual practice. The outcome of developmental research is initially a greater understanding of the educational artifact, process, or intervention and ideally design principles generalizable at some level, whether it be to refine the artifact, process, or intervention under study or transfer to other applications or contexts.

Richey and Nelson (1996) provide a comprehensive review of developmental research projects, which they classified as either Type I or Type II studies. Type I studies involve the design and development of products or processes within a developmental cycle, while in Type II studies researchers study what has already been developed with the intent of abstracting design principles for re -use. Meanwhile, van den Akker (1999) labels Type I as formative studies in which the goal is optimizing an intervention, while Type II studies are labeled as reconstructive studies and formulate design principles. In addition, van den Akker characterizes design principles to include substantive knowledge on "What to design?" and procedural knowledge, or "How should it be developed?" To add to our knowledge of what to design and how to design, says van den Akker, design principles should be justified by theoretical arguments, procedural detail, empirical evidence, and validated in multiple contexts.

Informing developmental research is formative research (e.g., Newman, 1990), which (a) identifies shortcomings and providing suggestions to a product or a process under development; (b) uses triangulation of methods, instruments, sources, and settings; and (c) evaluates quality criteria, such as effectiveness appeal/practicality, and efficiency. Complementing formative research are design experiments (Brown, 1992), involving the design and study of learning environments addressing complex learning problems in actual learning settings with practitioners. In using design experiments Brown reminds us how mutually informative studies done in classroom and laboratory settings can be. Decisions facing the researcher in design experiments, according to Brown, include participant size, involving individualized cases studying subject traits or the use of many subjects looking at a single variable. A second decision deals with changes over a chosen length of time, including cross-sectional studies from different groups, longitudinal data from a group over time, or microgenetic studies examining data over a short period of time. A third decision is the appropriate choice or mix of quantitative and qualitative techniques to use.

This paper discusses the methodological issues of using a developmental research framework to systematically design, implement, and evaluate a process; in this case, a reflexive approach for teaching instructional design (ID). The next section of the paper describes the developmental study, including the reflexive teaching model, the instructional sequence of the ID course, the developmental research framework, and study conclusions. A subsequent section will discuss methodological issues of developmental research, including data management and analysis, and the challenges of teaching and studying one's teaching. A final section provides guidelines on teaching decisions and matching developmental research prompts.

Developmental Study of ID Instruction

Reflexive Teaching Model

The major components of our reflexive approach for teaching instructional design include (a) characteristics and roles of instructor and learner, (b) co-participation structures, and (c) dialogue of teacher and student within each participation structure. Teachers and students are viewed as learners, each possessing unique learning beliefs, knowledge, competencies, experiences, sensibilities, and motivations. The instructor roles within the model include that of a learner, a designer of an instructional environment, and a teacher responsive to learner needs within this environment. The teacher assumes a supportive role, not unlike that of a coach (Schön, 1987). In terms of knowledge and competencies, the teacher must bring not only expertise in instructional design, but subject matter knowledge, pedagogical knowledge, pedagogical content knowledge, and knowledge of the learning principles of instructional design (Shulman, 1986). Student roles in the reflexive model include that of a learner with a willingness to engage within the participation structures and perform learning tasks. By reflexive we mean instructor and student learning of instructional design through multiple forms of activity.

Participation structures include the classroom, learning tasks (outside of the classroom), individual conferences, electronic mail, web site, and texts. Although careful consideration must be given to the design of these structures, some negotiation of their features by students is also encouraged. The key is being open to feedback and periodically "stepping outside" a teacher's perspective to consider these suggestions. Dialogue between the participants is crucial within these structures. For example, in a group activity, dialogue enables the knowledge of instructional design and one's views and experiences to be shared in an open and testable way, initiating a shared reflective process. Cooperative learning, presentations, and peer/teacher evaluations are key strategies. Within the structures dialogue with oneself through reflective tasks promotes ID understanding and understanding of one's own thought processes. Weekly written project drafts and feedback on one's performance help to develop reflective activity.

Instructional Sequence

The first two phases in the ID process in this course, Learning Beliefs and Design Tools (principally ID models), are used to establish the context for the traditional ID process (see Figure 1). Design-A-Lesson and Learning Principles tasks help students to reflect on how they currently plan instruction and their views on learning. Students draft a Mission Statement, which is used to assess how students' learning beliefs are being applied in their projects. Students also sketch a visual of their own ID model and provide an explanatory narrative.

ID INSTRUCTION: Instructional Design Phases

Setting the Context for ID		ID Project Development						Self Assessment
Learning Beliefs	Design Tools	Needs Assessment	Lesson Sequence	Instructional Framework	Assessment	Media throughout	Prototype	Program Evaluation

ID PROJECT: Learning Tasks

Design A Lesson Learning Principle	Prelim. ID Model	*Project Intent Statement* Needs	Sequencing Plan	Instructional Framework	Assessment	Teaching Demos and Prototype	Teaching Demos and Prototype	Revised ID Model Revised Self

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s Mission Statement		Assessment and Goals				Lesson	Lesson	Evaluation
		Conference					Conference	

Figure 1. Course sequence and learning tasks.

Students choose an instructional problem for an ID project and record their initial understanding of the problem through an Intent Statement. The Needs Assessment phase structures students' research into the instructional problem and options for addressing it. A personal conference provides individual assistance with their needs assessment strategy in terms of what to study, with whom to talk, what references to consult, and how to summarize their findings. Based on Needs Assessment, students identify goals for their project. Following Needs Assessment, students are introduced to design phases, which include Instructional Sequence, Assessment, Instructional Framework, Instructional Media/Technology, and a Prototype Lesson. Instruction helps raise students' awareness to the purposes of assessment and appropriate assessment methods. During the Instructional Frameworks phase in which teaching options are specified, students demonstrate a teaching strategy in their Prototype Lesson. Instructional Media and Technology is addressed throughout the course beginning with Needs Assessment. We urge students to be open to a range of media and technology possibilities and to make a case for how their choices support their goals. A second personal conference addresses Program Evaluation and individual project issues. The final week of the course has students submit revised personal ID models and a written self-evaluation of the course and their learning.

Developmental Research Methodology

To study the reflexive teaching approach, the design and development cycle (Richey & Nelson, 1996) was adopted as a research framework for six deliveries of an ID course from 1994-1998. In developmental research, objectives, rather than questions, characterize the inquiry. In this study we were interested in how the reflexive approach developed over time, and our research objectives for each delivery of the course included the following:

- Describe the design decisions.
- Describe the implementation of the model, or what occurred during each delivery.
- Describe the evaluation of the model, in terms of student learning and student perceptions of their learning and teaching.

The case study, defined as each class delivery, was chosen as the unit of analysis to describe the course development (Yin, 1994). Case 1 was a 5-week summer course with nine contact hours per week. Cases 2-5 were 15-week semesters, which met for three hours per week. Case 6 involved K-12 teachers from a school district/university-sponsored master's program, during a 15-week spring semester, which met off-campus for 3 hours once per week.

Participants included 113 students and two instructors in a master's level instructional design course from a university's instructional technology graduate education program. Of the 113 students, 73 had teaching experience. Educational levels of interest included 18 elementary school, 15 middle school, 26 high school, 6 with an overall K-12 interest, 29 college, and 19 training. The largest content area focus of the participants included science and technology (19), followed by language (17), computing (14), and special education (12).

Eight different data sources were used (see Figure 2), providing us with a means of data triangulation in which different sources of information informed the three research objectives (Yin, 1994). Data sources for design decisions included working logs, e-mail, and syllabi. Working logs documented our thinking and involvement in the ID course, including class presentations, learning tasks, student guide content, and teaching model representations. A syllabus recorded major design decisions for each case, including course purpose, instructional materials, assessment, and course sequence.

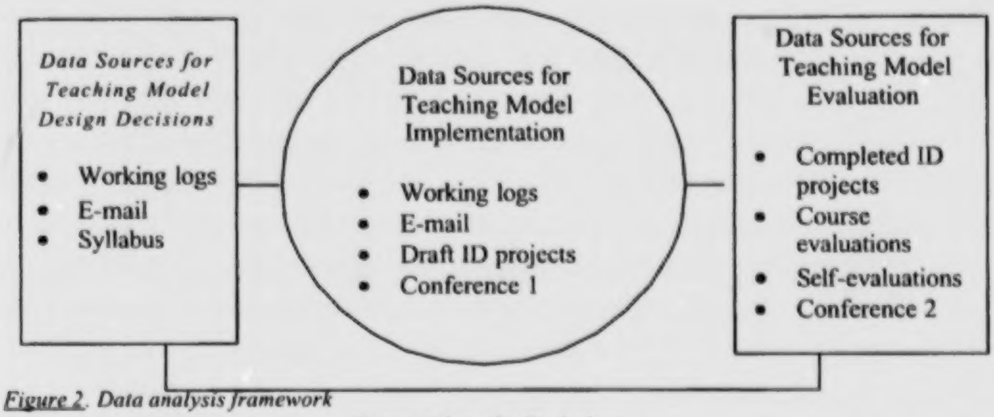
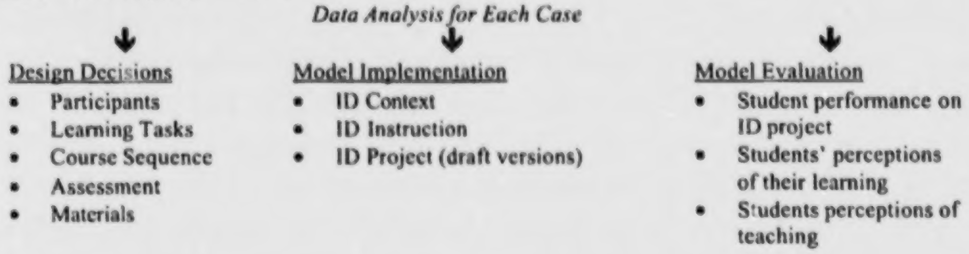

Data Sources for Teaching Model Design Decisions
Working logs
E-mail
Syllabus
Data Sources for Teaching Model Implementation
Working logs
E-mail
Draft ID projects
Conference 1
Data Sources for Teaching Model Evaluation
Completed ID projects
Course evaluations
Self-evaluations
Conference 2

Figure 2. *Data analysis framework*


Data Analysis for Each Case
Design Decisions
Participants
Learning Tasks
Course Sequence
Assessment
Materials
Model Implementation
ID Context
ID Instruction
ID Project (draft versions)
Model Evaluation
Student performance on ID project
Students' perceptions of their learning
Students perceptions of teaching

Data sources for implementation of the reflexive approach included working logs, e-mail, draft ID projects, and personal conference notes. Whenever possible during class, student comments and observations of class activities and student/instructor performance were recorded in working logs. Outside of class working logs recorded our perceptions of what occurred in class, summaries of weekly submissions of student work, and notes from weekly instructor meetings. E-mail was a source of instructor dialogue on weekly shifts in instruction and student needs. Draft ID projects provided evidence on how students transferred their ID process understanding into design decisions. The first of two personal conferences between instructors and student met early in the semester to discuss a student's project choice and needs assessment strategy.

Data sources for evaluation of the model included students' completed projects, course evaluations, student evaluations of their learning and written notes from a second personal conference. Required project components included a Mission Statement of beliefs about learning/learners/instruction, Project Intent Statement, Needs Assessment, Sequence, Assessment Plan, Instructional Framework, Instructional Media/Technology Plan, a Prototype Lesson, and a Program Evaluation Plan (formative and summative). Course evaluations included Likert-scale questions to record student perceptions of instruction, instructors and materials. Students also completed open-ended questions, which asked them to rate and/or comment on learning tasks and instructional materials. The self-evaluation task varied over each course delivery but typically asked students to summarize what they learned in the course, what they would like to learn next, and comment on their experiences with the course. Finally, a second student-teacher conference was conducted at the end of the course to address student questions on their projects.

For each case the design decisions were reported by describing (a) participants, (b) learning tasks, (c) course sequence, (d) assessment, and (e) instructional materials. Analysis of the implementation of the model for each case was reported by describing student performance and responses to instruction and instructor's assistance during (a) ID context activities, (b) ID process instruction, and (c) draft ID projects. Evaluation of the teaching model was reported on the basis of summarizing (a) student performance on the ID project, (b) students' self-perceptions of their learning, and (c) instructor responsivity to student needs. Details of the data collection and analysis procedures can found in Shambaugh and Magliaro (2001).

Developmental Study Conclusions

What we learned from this developmental study fall into two categories that also match our view of developmental research: a greater understanding of (a) a process; in this case, a reflexive teaching approach for ID instruction, and (b) the use of developmental research to study ID instruction.

Reflexive model understanding. A summary of what we learned about the teaching model is elaborated below.

- *Articulate the theoretical basis for a reflexive approach*: learning is constructed by the individual (Bruner, 1990), that there is a developmental interplay between one's thinking and the social world (Brown, Collins & Duguid, 1989; Fosnot, 1996; Lave & Wenger, 1991), and that teaching supports learning construction through multiple forms of assistance (Tharp & Gallimore, 1988). Teaching is not viewed as content delivery or communicating knowledge but the development of learning environments to support individual knowledge construction (Duffy & Cunningham, 1996).
- *The social system in which our reflexive teaching was embedded*: a reflexive stance regards teacher and student as mutual learners with different roles, both involved in a critical, self-appraisal of their activity within the learning environments (i.e., the participation structures).
- *Classroom syntax*: Out of this study the classroom participation structure was characterized by three phases, including (a) setting the stage, (b) representing understanding by instructor and student, and (c) debriefing. Our assistance to student learning was also depicted in a responsivity cycle involving (a) design and implementation; (b) mutual engagement, performance, and reflection; and (c) submit learning tasks, query instructors on issues, and respond to student concerns.
- *Principles of student reaction*: How students reacted to the teaching are summarized by individual ID phases.
- *Support system requirements*: In this model students were new to learning beliefs examination, were sometimes uncomfortable with submitting work-in-progress versus finished work, were new to detailed feedback from instructors, and required some time to take responsibility for design decisions responsive to learners versus what instructors wanted.
- *Requirements for co-participation*: Joint student-instructor learning required a (a) willingness to share control and responsibility for learning, (b) a readiness for dialogic education, and (c) a genuine desire to be reflexive in one's teaching and learning.

Developmental research understanding. Our understanding of what it meant to study our teaching using a development research framework included the following.

- *Model representation*: our description of the model provides a basis for subsequent development of the model for purposes of exploration, prediction, and planning.
- *Model development*: a theoretical basis for a model must be articulated and one must be clear as to the purposes of the developmental study to study the model; in particular, what knowledge, understanding, or predicting is being developed.
- *Data management*: maintaining systematic data management procedures are crucial to track the evolution of the model prototype and to make any generalizations across time.
- *Individual and collaborative requirements*: a reflexive disposition is needed to study one's teaching.

Developmental Research Issues

This section provides more details on methodology issues involved in the above developmental research study.

Data Management and Analysis

Data management in developmental research involves the procedures for a systematic, coherent process of data collection, storage and retrieval for the purpose of high quality, accessible data, the documentation of analysis, and retention of data (Huberman & Miles, 1998). In this study data were analyzed using the qualitative techniques of Miles and Huberman (1994), which consisted of data reduction from original data sources using categorical analysis (Spradley, 1980) and display of this reduced data in "frames" or tables that enabled conclusions to be drawn. The data analysis sequence included collecting data, reducing the data into frames, and reporting the reduction in an analysis section. The data reduction documents for each case were kept in 3-ring notebooks and each notebook was divided by data sources, a strategy that served to separate the data from the report and provided a means to organize the data and track the analysis sequence from data source to data reduction to data reporting.

Describing design decisions was straightforward. Syllabi concisely recorded these as well as what was written in working logs, which recorded dialogue between instructors over time as to what ID content means and how to teach this content. Implementation of these design decisions in an actual course was also relatively clear to record in Working Logs in terms of what we as instructors implemented and how students reacted to these decisions from what they said and what they designed during the semester. Weekly submissions of draft ID project components were evaluated in terms of performance criteria. Criteria for each project component were communicated to students using a task sheet.

Evaluation of student learning was more complicated. The ID projects were the principal source to indicate student performance of ID understanding and were analyzed for (a) completeness (i.e., Were all of the project components in place?), (b) consistency of learning beliefs across design components, and (c) coherence of design components. For consistency, important ideas (e.g., assisting learners, skill proficiency, working together, problem solving, multiple instructional approaches) were identified from a Project Intent Statement. The ID project was reviewed to note whether or not these ideas were explicitly addressed in the projects. For example, if a student wrote about the importance of students working together, we looked for this feature in the instructional approach, activities, or prototype lesson. A Mission Statement recorded what students believed were important teaching and learning principles. The ID project was reviewed to note whether or not the features of the Mission Statement were addressed in the projects. For coherence, notations were recorded in terms of how each design component was represented. A judgment was made whether or not these design components appropriately supported each other, such as a match between assessment methods and teaching.

Each case was a description of "what happened and how the course proceeded" using design decisions, model implementation, and evaluation of the model as a way to describe the use and results of the model (between-case analysis). Data displays, structured summaries, and tables allowed a condensed view of the data sources and revealed that some further analysis was needed, such as coding of structured summaries to reveal themes as well as to identify exceptions and differences.

The summary of an across-case analysis of the six cases (across-case analysis) reported the changes in design decisions, implementation, and evaluation of the model (see Shambaugh & Magliaro, 2001). As Huberman and Miles (1998) have commented, "each case has a specific history–which we discard at our peril–but it is a history contained within the general principles that influence its development" (p. 194). This summary attempted to preserve the uniqueness of each case, yet also make comparisons along the developmental cycle based on repeat deliveries of the course. In an effort to extend external validity, what participants' "did, said, or designed," were examined in multiple settings. The description of the reflexive model, based on what was found fromthis analysis, provided a set of generalizations on how the model was implemented, as well as conditions necessary for its use. The danger to this generalization was that "multiple cases will be analyzed at high levels of inference, aggregating out the local webs of causality and ending with a smoothed set of generalizations that may not apply to any single case" (Huberman & Miles, p. 194). We did not average, for example, course evaluation results (i.e., from Likert scales) to avoid misinterpretation and superficiality and to preserve case uniqueness. The goal was to better understand the overall processes at work across the cases, including teacher and student thinking, participation, and teacher responsivity.

In traditional instances of qualitative data collection and analysis, the research "shifts between cycles of inductive data collection and analysis to deductive cycles of testing and verification" (Huberman & Miles, 1998, p. 198). In this study, sources of data were already in place prior to conceptualizing a study framework. However, the details of the framework and the subsequent data analysis of the six cases cycled back and forth to realize more appropriate matches of methodology and method to existing data sources and research objectives. The analytic cycle for this study could be better described as one that moved between conceptual framework, case analysis, and study purpose. Although being clear as to the purpose of a study is preferable before constructing a methodology, such clarity is not always possible due to the complexity of processes to be studied, data, and personal involvement over time. This reality requires teachers-researchers who feel comfortable about this dynamic movement and emergence of understanding.

One possible source for bias in this study is the large amount of data, which may have led to missing important information or overweighing some findings due to focusing on a particular and large set of data. Personal involvement with the course also increased the possibility that recorded observations in working logs highlighted particular incidents while ignoring others. The working logs, however, served as a "reflexivity journal" (Carney, 1990) and recorded observations or design decisions that would have been lost to our collective memories over the five years of involvement. Personal involvement as co-instructors also implied a danger in being selective and overconfident with some data. Another shortcoming was not checking descriptions with each case of students and additional peer review outside of the co-instructor.

To address these shortcomings, we used multiple data sources for triangulation to achieve an agreement of one data source with another. Multiple sources of data, such as working logs, e-mail, and syllabi, also provided different strengths and complemented each other. Syllabi, for example, compactly recorded design decisions, while working logs and email documented our thinking that influenced these decisions. The data sources were a mix of student-generated (i.e., conferences, ID projects, course and self-evaluations) and instructor-generated (i.e., working logs, e-mail, syllabi) data.

During the analysis of these data sources we looked for contrasts, comparisons, and exemplars and reported these during the data reduction so as not to filter out outliers and extreme instances. Replication of the conceptual framework across multiple cases helped to provide evidence that what was described in each case was based upon the details of the instructional approach and uniqueness of the setting and participants. We were conscious to remain "descriptive" in the writing during the analysis of each case.

Another means of addressing verification of methodology, findings, and conclusions was an "auditing" by the co-instructor. Through periodic reviews of methodology and analysis, inconsistencies in design decisions were identified and prompted for clarification. Such feedback characterized another aspect of our reflexive stance, the need to assume regular, ongoing, and self-conscious documentation of teaching.

Balancing Design-Teaching and Developmental Research

The design decisions, implementation, and evaluation of the ID course were event-driven, meaning that they served our instructional needs to watch, ask, and examine (Wolcott, 1992). These observations, interviews, and documents were in place prior to the conceptual framework of the study. As a result, the data sources were not as complete, tightly defined, or structured across the six cases if they had been researcher-driven. Some data sources, such as syllabi, course evaluations, and self-evaluations, evolved to suit the learning needs of the students. However, because we had presented preliminary findings at research conferences (e.g., Shambaugh & Magliaro, 1995, 1996), we had collected and stored data for each case, as well as conducted analysis with most of the data sources, although using different methodologies. These research efforts can be regarded as interim analyses in which we became familiar with studying teaching and learning products, developing procedures in recording observations and personal conferences, as well as retaining and analyzing documents. Over the six cases, we came to better understand the instructional setting, being sensitive to research opportunities and becoming more systematic in our data collection and management efforts, but also retaining instruction and responsiveness to learners as our top priority.

Developmental Research Guidelines

From this study we have become more aware of how designing/teaching can be informed by adherence to research tenets, as well as more trustworthy results that can be obtained by structuring teaching decisions and learning artifacts as data sources. The following guidelines for conducting developmental research are organized along the developmental research cycle, consisting of design, implementation, and evaluation components (see Figure 3) and are listed first by teaching decisions and in the second column by developmental research prompts. The guidelines address both designing and teaching, activities customarily viewed as separate, but are viewed by us as complementary. Design requires the involvement of practitioners who bring insight into practical implementation problems, and our belief that designer and teacher can be one and the same.

Design Guidelines

A major teaching decision is determining the purpose of the instructional intervention, through the use of course goals. A complementary developmental research prompt is being clear as to the purpose of the research. By answering the question, "What is this study about?" an appropriate methodology to study the research question(s) can be formulated. Developmental research objectives help to understand the complex phenomena at play in any educational intervention, so as to provide initial descriptive data for subsequent research questions.

Design and teacher thinking can be made explicit by recording design conversations and decisions from notes, lesson plans, unit plans, curriculum guides, or syllabi. A more comprehensive representation of one's teaching can be documented in an instructional framework, using the conceptual approach of Joyce, Weil, and Calhoun (2000). The instructional framework records the theoretical learning foundation of the different teaching approaches, describes the social and support systems of the approaches, specifies syntax or procedural guidelines of to implement the approaches, and the instructional and nurturant effects of the teaching.

Another set of design/teaching decisions is to think through the activity roles of the teacher and the student and to identify the purpose of the activities, determine if the activities are developmentally appropriate, and sequenced appropriately. Thus, one can examine the alignment between desired learning outcomes, teaching options, and assessment. Developmental research prompts here would retain copies of learning activities and tasks so as to provide evidence of how these data sources evolved over time to support teaching adjustments.

Implementation Guidelines

Implementation guidelines for teachers involve ongoing evaluation of one's design/teaching decisions and dynamic adjustments needed during the intervention to address the desired learning outcomes. From a developmental research point of view, these design and/or teaching adjustments need to be recorded so as to provide a clear description of what occurred. Also, any changes in activities or tasks need to be documented to provide a description of how these data sources evolve over time.

It is possible during implementation that other forms of learning may be occurring. A research prompt can be useful to continue looking for phenomena that may be occurring but not addressed through a methodology or that emerges as a result of what occurs from the intervention or from "looking at classrooms" in new methodological approaches. Each school year or course delivery provides a unique set of learners and learning characteristics that must be analyzed in developmental research as a unique case.

During implementation teachers remain conscious of student perceptions to their teaching and the tasks and activities provided for them, as well as ongoing assessment of the ways in which students are learning or not learning. Are the assessment methods providing this information? Developmental research prompts here include habitual analysis of ongoing assessment, whether observations, interviews, or learning artifacts. In addition, the development of instruments to periodically assess student perceptions provides a new data source for implementation analysis and teaching adjustments.

Evaluation Guidelines

Evaluation guidelines primarily involve the examination of student performance on learning tasks and feedback on teaching efforts. Developmental research requires data sources that reveal student learning in terms of learning outcomes, as well as student or peer perceptions on teaching. Multiple forms of data from student activities (process and product forms) provide triangulating evidence of student learning. A challenge here is to maintain systematic data collection and management procedures in light of busy school schedules.

A secondary set of evaluation guidelines encourages designers/teachers to solicit feedback and advice from peers and other sources. Developmental research prompts teachers to collaborate on teacher studies and to disseminate findings.

Designing/Teaching Decisions	Developmental Research Prompts
DESIGN	
What is to be learned in this intervention?	What is the purpose of the study? Be explicit about how teaching will be studied through research objectives
Make explicit teacher thinking. Determine if there is an alignment between learning outcomes, teaching strategy, and assessment.	Record and store design decisions from conversations, notes, or lesson plans, syllabi. Document instructional framework, including theoretical foundation of teaching (Joyce, Weil & Calhoun, 2000)
Identify and describe teacher and student activity.	Examine teacher and student activity as data through reflective and performance artifacts. Retain copies of learning tasks.
IMPLEMENTATION	
Continually evaluate appropriateness of design decisions to learning outcomes. Document teaching activities and adjustments.	Document changes in data sources as they evolve over time to address research objectives.
What other forms of learning are occurring or not occurring? (incidental learning)	Document direct (learning goals) and indirect (nurturant) effects of instruction (Joyce, Weil & Calhoun, 2000).

Determine learning characteristics of students.	Each course delivery analyzed as a unique case.
Examine assessment criteria.	Are assessment criteria analyzable?
How are students learning and perceiving your instruction?	Develop instruments to obtain student learning and student perceptions.
EVALUATION	
Keep records on student performance.	Identify data sources that reveal student learning. Maintain systematic data management procedures.
Solicit feedback from students and listen to what they say.	Identify data sources for student perceptions of teaching. Maintain systematic data management procedures.
Seek out feedback from peers, develop teaching repertoire.	Collaborate on research into one's teaching, disseminate findings.

Figure 3. Designing/teaching and developmental research guidelines.

Implications

The downsides of research for designers-teachers have been characterized by van den Akker (1999) as answers that are frequently too narrow, too superficial, or too late to do any good. Developmental research aims to address these issues of meaningfulness, generalizability, and usefulness. Developmental research can be used to assist designers and teachers in the development of educational interventions, while providing a systematic means to study their implementation. As all interventions are influenced by multiple stakeholders and are contextually-rich in nature, developmental research provides a dynamic vantage point for collaborators to talk about their roles, whether these roles be pragmatic (design, teaching) or knowledge-building (research). Developmental research also provides a framework to study instructional problems and responses, particularly as changes in the methodological framework may be required to adapt to evolving response prototypes.

Reeves (2000) provides several heuristics for developmental research activities, including the need to focus on difficult learning problems; align designs with learning outcomes, teaching, and assessment; collaborate and share with others; and the hard work needed for any developmental research project. Another critical heuristic suggested by Reeves involves identifying the theoretical and practical design principles that underlie a prototype and conduct rigorous studies of these principles in real settings. Carroll (2000) reminds us that viewing design as inquiry "raises the question of what abstractions can support the development and sense of knowledge in design" (p. 65). In particular, we raise to ourselves and others two challenges; namely, (a) the difficulty of abstracting principles or frameworks to help us in designing contextually-rich learning environments, and (b) acknowledging in developmental research the naturalistic nature of teacher knowledge. Both of these challenges resonate with the twin purposes of developmental research raised at the beginning of this paper: (a) formulating what we learn from our design efforts and (b) developing responsive educational interventions.

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Leadership in Higher Education: Instructional Designers in Faculty Development Programs

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Abstract

Instructional designers are well equipped to handle the leadership of faculty development in higher education. Faculty development is part of the process of lifelong learning for the college or university instructor and a key component of the transformational changes taking place in higher education. The need for faculty to appropriately integrate technology into their curriculum and utilize innovative instructional methodologies is driven by five factors: students, faculty, administration, society, and technology. The role of instructional designers and instructional systems design methodologies are critical to the success of faculty development programs and can successfully facilitate the dynamic change process currently underway in colleges and universities.

Faculty development in higher education is a part of the process of lifelong learning for the college or university instructor and a key component of the transformational changes taking place in higher education. Five factors are driving the need for faculty to appropriately integrate technology and instructional systems approaches into the design and development of their courses: students, faculty, administration, society, and technology. A skilled instructional designer is a well-trained professional for assisting faculty members and serving faculty development programs to better utilize innovative instructional methodologies, strategies, and techniques. The anticipated outcome of the current transformation in higher education is improvement in teaching facilitated by faculty development initiatives under the guidance of the instructional designer.

The Transformation of Higher Education

Change is happening within many sectors that have direct influence on colleges and universities and the effects are certain to alter the way in which higher education operates in the future. Managing the transformation is the key to survival for colleges and universities. Understanding the forces of change requires leadership that is skilled in evaluating and synthesizing the inter-relatedness of the variables involved. Technology, as an innovation, consistently creates changes in the way people and organizations function, access information, and communicate. The transformation of higher education can be understood in terms of the forces that are driving the need for faculty development. The changing student character is creating the need for faculty to adopt new teaching strategies. The need of faculty and administration to accomplish their respective functions drives the need for and enables the establishment of faculty development programs. The changes in the demographics, culture, and nature of work in society are reflected in the expectations of graduates. The application of technology to educational objectives creates an evolving, dynamic environment for learning, and subsequently requires an improved, dynamic methodology of teaching. Based on their knowledge of systems theory and change management, instructional designers can serve as change agents within faculty development programs.

Role of Faculty Development in the Transformation of Higher Education

Faculty development is a process of professional training (and retraining) undertaken by instructors in higher education. Like its corporate counterpart, faculty training and development is important for maintaining or improving the quality of services and products offered by the organization. Highly skilled faculty is the core of a top quality academic institution and is the primary producers of critical higher education products: prized research and educated graduates.

A working definition of faculty development will help clarify this topic and show the far-reaching boundaries that support its role as a catalyst for transforming higher education. Faculty in colleges and universities are undertaking fundamental remodeling of their teaching approaches. Duderstadt (1999) believes that faculty in higher education will require new instructional methods, models, and techniques for serving the learning needs of the future generation and that faculty development initiatives are instrumental in guiding the transformation. Typically, the literature addresses faculty development only in terms of integrating technology into the teaching and learning experience. While technology should play an important role, it remains a mere tool to support fundamentally good educational practice.

Faculty development can also be viewed as a process of careful identification of past teaching successes and the generation of ideas, beliefs, and convictions about teaching and learning. From these beliefs it is then possible to choose among the many new tools, technologies, and instructional strategies available. Faculty development programs are focused on the integration of educational technology tools, such as, the Web, hardware, software, and the appropriate use of audio-visual equipment, into a faculty member's established teaching practices. Instructional strategies and methodologies include the instructional systems theories, models, and strategies for analyzing, designing, developing, implementing, and evaluating educational experiences and outcomes.

Faculty development is for the purpose of improving teaching and learning at undergraduate and graduate levels. American colleges and universities have been making numerous efforts to improve teaching and learning on their campuses since the 1980s. As a result, some changes have occurred and the repertoire of teaching practices has expanded, such as greater student involvement through collaborative and cooperative learning; technology-based learning; learning communities to bring faculty and students closer together; and teaching centers to improve practice. Despite the various pedagogical innovations there has not been enough deeper reform. There is little evidence that the changes amount to a real systemic reconsideration of how and why students learn or of how institutions, not just faculty, can revise their approaches to teaching (Lazerson, Wagener, & Shumanis, 2000).

Rationale for Faculty Development

Why is there a need for faculty development? A few reasons for undertaking faculty development initiatives emerged from the literature. The primary reason is to help faculty to move their teaching, research, and service forward, which are the three parts of the higher education mission. The goal of improving skills and techniques is equivalent to innovating, which is required for continuing to meet the needs of the stakeholders in higher education, namely students who enroll for the purpose of learning. In most cases, faculty in higher education are paid for teaching but rewarded for scholarship. Further, most faculty are not trained in instructional design and methodologies, as are graduates of teacher education programs (Noone & Swenson, 2001). They learned how to teach by the example set for them by their instructors and then perhaps modified those practices based on actual classroom experience. As research on effective teaching and learning methodologies moves forward, adoption of the best practices by faculty must move with it. Instructional technology practitioners help the internal processes of faculty development by providing the necessary training and support for both pedagogical and technological issues.

Faculty development initiatives have cross-interaction effects with five key areas of the college and university: student acceptance, administrative policy, faculty adoption, technology integration, and the societal context in which the institution functions. Addressing the needs for faculty development has a significant holistic impact on the institution and can act as an energizing catalyst for the systemic change and transformation of higher education. The instructional designer operating within higher education should develop an understanding of this dynamic interaction for the improvement of faculty development initiatives.

Driving Factor: Students

Today's students are more wired, technologically savvy, and connected than any previous generation their character has been shaped by a fast-food style, digital revolution of media and near instant access to information, has little desire for the traditional modes of teacher-centered classroom instruction. Their desires for technology-enhanced experiences are not limited to personal use. Students' expectations for technology-enhanced, practical, collaborative, real-world learning environments contrast with the majority of faculty who still depend on lectures as their prime teaching method (Hansen & Stephens, 2000; Noone & Swenson, 2001). Students are the consumers of the higher education institution's products. If teachers continue to teach in the same way that they have always taught, they will lose the interest of this digital generation and miss the mark of helping to educate, and thereby transform, today's diverse students. Frand (2000) suggests higher education needs to account for the new attitudes and beliefs of students and transform the educational experience so that it is meaningful to the information-age learner. Given an increasing awareness of duty to undergraduate students, colleges and universities, particularly research universities, are engaging in lively debate on how much attention should be paid to undergraduate education (Kennedy, 1998).

Driving Factor: Faculty

Forces of change are most productive when they originate from within the entity that needs changing. Faculty is a key subset of an institution's administrative body, and may be considered the most significant driving factor affecting faculty development. The opportunity for facilitating the change through faculty development programs is one that faculty have begun to take advantage of, but not in such a manner as to have the intended effect. Lazerson et al. (2000) report "...efforts to improve teaching and learning have been supported only in part by faculty and institutions as a whole, with results that are neither significant nor pervasive." When faculty perceive there is a need to change and they understand the true benefit of change to their professional development, there will be a tremendous shift towards faculty development. According to Brown (2000), the shift is occurring now. Scholars worldwide are creating a storm of educational technology experiments. As they assemble in conferences, hallways, and special panels, they are seeking to engage in the issues and opportunities arising from technology-enhanced learning. Faculty seem to be undertaking fundamental remodeling of their teaching approaches and giving a thoughtful consideration of pedagogy. Even though professional development for faculty is important, it is not enough to ensure support for and adoption of technology for teaching. It is a mistake to frame the issue as one of training faculty, which tends to put the "blame" on faculty members and implies that they are the problem that needs to be fixed. Professional development is the last stage in a broader, holistic change process (Bates, 1999). Given the proper conditions of creative energy and institutional loyalty, the faculty is willing to experiment and to engage actively with the needs of students (Kennedy, 1998). In response, faculty members are asking for help from their administrations and one another.

Driving Factor: Administration

The holistic change process is in large part, the purview of the administration. The administrative function of colleges and universities is a driving force on faculty development by virtue of their responsibility for setting policy, managing financial and capital resources, and ensuring the ongoing vitality of the institution. The administration knows that faculty is the key source of a healthy environment, but they must also take action for altering the current atmosphere to invite change. Transformational change powered by the technological revolution is constrained when mistakenly held within the context of the old organizational structures. This is the "mirage of continuity" that denies the need for reorganization of financial and management systems. Outmoded administrative units falsely believe the historic tradition of knowledge creation and transmission can be transformed by the simple substitution of digital for analog technology. A new conception of the university is needed (Battin & Hawkins, 1998).

Policy should precede and guide action. Kennedy (1998) suggests that in order for the transformation of a college or university to occur, institutions require new methods of making faculty members feel responsible for the institution and for its students. One suggested way is to develop a more centralized sense of direction, while at the same time, maintaining a shared governance structure in which faculty members feel more like stakeholders. To help this process, institutions must be more flexible and responsive to new needs, trends, and opportunities, by setting aside funds for new initiatives and perhaps most importantly, by cultivating the spirit of innovation.

Action follows and supports policy. The adoption of academic technologies is a strategic imperative for higher education. The first step in the process of reinventing instructional technology is to convert it into a strategic tool tightly incorporated in well-defined and well-researched institutional objectives. Most every college and university mission statement lists "quality teaching and learning" as one of its key strategic objectives, but have not adequately defined the meaning of "quality learning" with respect to new workplace skills and individual student needs or associated the criteria to particular instructional technology strategies that can be used to achieve them (Privateer, 1999).

Driving Factor: Society

Faculty development, as the primary catalyst for change in two core areas of the university—teaching and learning—is positioned to lead the transformation of the university to meet the needs of the 21st century society dominated by electronic technology (Battin & Hawkins, 1998). Society provides the context in which higher education institutions exist and ultimately serves. The relationship is symbiotic—society produces the students who matriculate and then graduate with some increased capacity to productively serve society. Kennedy (1998) observes that society is paying attention to higher education as evident by media reports of academic scandal, research misconduct, and athletic scholarship violations, as well as more thoughtful and private criticism of employers, government leaders, and parents. It can be said that some attention, even negative, is a sign that Americans care about colleges and universities.

Society perceives higher education as the archivists of cultural heritage and conservators of its history for the purpose of passing both on to subsequent generations of students. It is in the best interest of society that colleges and universities are effectively fulfilling these responsibilities (Kennedy, 1998). These expectations of a changing society on higher education have implications for how teaching and learning is carried out. Employers are a primary stakeholder in society and are looking for graduates who are problem-solvers, which require higher order thinking skills and good collaboration skills. In addition, the changing nature of society—characterized by eras of economic shifts from industrial to information to knowledge—places pressure on colleges and universities to improve the information intelligence of its graduates. The establishment of information science departments within universities in recent years evidences this trend. Faculty will require new skills for delivering, monitoring, and assessing the types of instruction that encourage the maturation of higher cognitive functions and better collaboration skills in students.

Driving Factor: Technology

Technology advancements both drive and support faculty development initiatives. Technology is in constant change. Each advancement or application to education opens new possibilities for its adoption and diffusion in the teaching and learning enterprise. Faculty should seek professional development to better understand and possibly integrate technology into their practice. Like a high-speed train, technology is a rapid transportation vehicle to new levels of learner knowledge construction. Faculty must choose to ride the train, step off, or at least, move out of the way. Given the risk and potential reward of integrating technology into an existing academic paradigm, much more time and research will be needed before a set of "best practices" for the use of new technologies in higher education can be determined. Meanwhile, change is happening at a rate not seen in higher education for a long time. In most colleges and universities, innovation has historically been descriptive of research and scholarship, not teaching methods. The new digital technologies now make bold and creative educational experimentation possible (Farrington, 1999). With each new telecommunication innovation, the basic nature of learning and teaching is changing and creating new ways to process and disseminate information. Instructional technology leaders must be a part of the decision making process when telecommunications and computing technologies are determined (Withrow, 1994).

The Role of Instructional Technology and Instructional Designers

By its innovative nature, instructional technology creates a dynamic for change wherever it is properly used. In particular, computer and telecommunication technologies forces institutions and individuals to adapt to the revolutionary ways in which data and information are stored, retrieved, and communicated. The traditional tasks of editorial criticism and evaluation of course assignments can now take place electronically and, in the best circumstances, link professor and students more closely for more of the work than ever before. Instructional technology facilitates the effective design process of innovative learning environments through the use of efficient systematic methodologies and strategies.

It is a positive note for the instructional technology field that instructional designers are increasingly appearing on the payrolls of universities, namely in faculty development and support programs. Surry (1996) reports that instructional designers are steadily being hired in higher education and in a more recent study, Surry and Robinson (2001) categorized hundreds of educational technology job postings. The instructional design leaders who fill these positions will need to have supplemental skills, such as project management and facilitating change to complement their ISD skills. Their backgrounds and experiences, more than any other professional field, qualify them to handle the dynamic nature of change in educational technology and its application to learning processes and teaching strategies.

As the transformation progresses, faculty will continue to need training and refreshers in the skills that are essential for teaching and learning with technology; support during the development process; and advice for the effective integration of media and information technologies. Instructional technology practitioners need to be prepared for these challenges. Duderstadt (1999) said so well, "The real question is not whether higher education will be transformed but rather *how* and *by whom.*" Instructional designers are the professionals prepared to be involved in the transformation and should seek leadership positions in order to positively affect organizational change during the transformation. In addition, it will become incumbent upon them to make contributions to the instructional technology knowledge base regarding research, instruction, process, and outcomes of faculty development initiatives.

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Conclusion

To secure future viability and fulfill its tripartite mission of teaching, research, and service, higher education must choose a better strategic path. If they want to reinvent themselves, they have to take a long and hard strategic look into how their delivery of instruction conflicts with the cognitive potentials of contemporary information technologies. Instructional designers are uniquely qualified to take on significant leadership roles within higher education to manage faculty development programs. Faculty development is a component of the process of lifelong learning for professors and educators in higher education and a key component of managing the transformational changes taking place in higher education over the next decade. The key concept of faculty development as a transforming agent of colleges and universities is accepting, understanding, and managing the dynamic changes brought about by the five external and internal factors: students, faculty, administration, society, and technology. These factors drive the need for faculty to integrate technology into their curriculum and utilize new instructional methodologies, strategies, and techniques.

Students' expectations for technology-enhanced, practical, collaborative learning environments contrast with the majority of faculty who still depend on lectures as their prime teaching method (Hansen & Stephens, 2000). If teachers continue to teach in the same way that they have always taught, they will miss the mark of helping to educate (transform) today's diverse students and make the educational experience meaningful to the information-age learner (Frand, 2000).

The opportunity for facilitating the change through faculty development programs is one that faculties have begun to take, but with modest results that are neither significant nor pervasive (Lazerson, et al., 2000). When faculty perceives there is a need to change and they understand the true benefit of change to their professional development, there will be a tremendous shift towards faculty development. Even though professional development for faculty is important, it is not enough to ensure support for and adoption of technology for teaching. A holistic change is needed to support faculty adoption.

The holistic change process is primarily the leadership responsibility of the institution's administration. The administrative function of colleges and universities is a top-down, driving force on faculty development characterized by setting policy, managing financial and capital resources, and ensuring the ongoing vitality of the institution. The administration knows that faculty is the key source of a healthy environment, but they must also recognize the need to alter the current atmosphere to invite change. Transformational change should not be constrained within the context of the old organizational structures. Battin and Hawkins (1998) refer to this as the "mirage of continuity" that denies the need for reorganization of financial and management systems. Historic tradition of knowledge creation and transmission must be replaced with a new conception of the university.

The expectations of a changing society on higher education have implications for how teaching and learning is carried out. Employers are looking for graduates who are problem-solvers, which is challenging to teach in every discipline. Nevertheless, the changing economic nature of society places pressure on colleges and universities to improve the information intelligence of its graduates. Faculty will require new skills for delivering the types of instruction that encourage the maturation of higher cognitive functions and better collaboration skills in students.

Given the risk and potential reward of integrating technology into an existing academic paradigm, more research on the best uses of the new technologies is needed. New digital technologies allow for bold and creative educational experimentation. Instructional technology, by its innovative nature, facilitates change wherever it is appropriately used. To secure future viability and fulfill its mission of teaching, research, and service, higher education must choose a better strategic path. If they want to reinvent themselves, they have to take a long and hard strategic look into how their delivery of instruction conflicts with the cognitive potentials of contemporary information technologies. The key concept of faculty development as a transforming agent of colleges and universities is accepting, understanding, and managing the dynamic changes brought about by the five factors: students, faculty, administration, society, and technology.

The instructional designer is one of the best prepared education professionals to provide training in the skills that are essential for teaching and learning with technology, to provide support during the instructional development process, and to offer pedagogically sound guidance for the effective integration of media and information technologies. Instructional technology practitioners should seek leadership positions in faculty development programs. The result is likely to positively affect implementation of ISD practices, theories, and strategies into faculty development. The instructional designer is a versatile education professional that can offer valuable skills and facilitate appropriate use of instructional systems design for improving teaching and learning methodologies in faculty development programs. In this capacity, instructional designers can play a key leadership role in the transformation of higher education.

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Co-Inquiry Approach to Learning and Using Hypermedia

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Abstract:

This article analyzes the uses of various technologies to enhance literacy practices using a multi-genre writing project with pre-service teachers and middle school students. Twenty-seven English pre-service teachers, simultaneously enrolled in a methods and a technology course, collaborated with middle school students using asynchronous web discussion to develop hypermedia projects that fostered and promoted the use of technology as a tool. These tools mediated the uses of various literacy practices within the larger activity system of teacher education, whose object is to assist teachers to acquire those practices involved in working effectively with students. Qualitative data were collected through analyzing preservice teachers' development of Storyspace hypermedia projects, the use of asynchronous discussion with their middle school students, and participation on a WebCT bulletin-board discussion. The hypermedia productions with middle school students helped the preservice teachers learn how to model the literacy practices of making intertextual or hypertextual links. The web-based communication with students helped preservice teachers develop relationships with students in the absence of face-to-face interaction. And, through participation in the WebCT bulletin board, preservice teachers employed different literary practices ranging from the display of spontaneous thinking to engaging in word/role play.

Literacy Practices and Technology Tools

A preservice teacher and a middle-school student are exchanging messages on a web-based bulletin board about a biography project they are working on together on the topic of Princess Diana. The student posted the following message:

> Last night I went on the Internet and found a lot of stuff like her will, and her divorce papers and some poems some people wrote about her. I also fond some pictures of when she was younger.

The preservice teacher responded:

> Last night I bought a couple of books about Princess Diana that were on sale at the bookstore. One contains a bunch of short little memories of her written by all sorts of people that knew her in her lifetime. I will also print at least 2 articles from the Internet that will be helpful (not too long) for us to think about what we want to write about.
>
> See you Wednesday.

This on-line exchange was part of a project involving preservice English teachers working in a semester-long practicum experience with a group of middle-school students, a project that involved extensive uses of technology. Their on-line exchange entails uses of literacy practices such as sharing information and planning activities, practices central to a co-inquiry writing project. This project represents the increasing use of technology as a tool for linking adults with students in schools, an approach that is highly relevant to teacher education.

In many teacher education programs, in addition to their student teaching, preservice teachers are required to complete practicum experiences that involve minimal face-to-face interaction with students. Technology can enhance preservice teachers' interaction with students, as well as providing students with positive learning experiences through technology. For example, in the "Fifth Dimension" after-school computer-mediated program operated by the University of California, San Diego, participation in an elaborate set of computer games and activities resulted in increased student engagement, participation, and learning within a community (Cole, 1999). In this program, University undergraduates serve as "Wizards" who guide students through a "maze" of activities based on the students' zone of proximal development.

Educators are also employing web-based tools to foster on-line discussions between teachers regarding issues faced in their programs or in the classroom. The Inquiry Page housed at the University of Illinois <http://inquiry.uiuc.edu/> is designed to help teachers share teaching successes and collective expertise (Bruce & Davidson, 1996; Bruce & Easley, 2000). Teachers engage in mutual inquiry through their access to resources on teaching and learning, articles, project links, curriculum units, and content resources. Users of the site are themselves the developers who reconstruct the tool as they use it. Participants may also share video, photos, graphics, texts showing people engaged in inquiry in different settings and access resources involving a dynamic incorporation (using Digital Windmill) of the Open Directory category on Inquiry Based Learning.

This site represents new generation of web design that serves the social needs of teachers to mutually engage them in co-inquiry about problems, issues, or dilemmas. Research on uses of these sites indicates the importance of quality of the social interaction in this on-line co-inquiry. For example, Barah and Schatz (2001) analyzed the development of a web-based learning site designed to foster sharing of inquiry-instruction ideas by Indiana math and science teachers in terms of the components of evolving activity systems. This web site was initially designed as a tool by University educators to achieve the object of more discussion/sharing about inquiry instruction with the outcome being improved understanding of inquiry-based instruction. However, given the lack of participation, the University educators, along with teacher participants, shifted the focus of the web site to emphasize participants' mutual collaboration at the site around inquiry-based math/science instruction.

In this report, we examine the various literacy practices that were fostered through the uses of technology tools that included web-based bulletin-board exchanges and hypermedia productions. We hope to demonstrate that technology tools can serve to mediate and foster the development of a range of different literacy practices within a teacher education program.

Technology Tools as Mediating Literacy Practices

Social-cultural activity theory of learning (Cole, 1996; Engestrom, 1987; Wertsch, 1998) posits that learning occurs through social uses of various tools –language, signs, images, texts, as well as technology tools. Activity theorists believe that people learn the uses of these tools by learning how they are linked to the objects or outcomes driving a specific activity within an "activity system." Russell (1997) defined an activity system as: "any ongoing, object-directed, historically conditioned, dialectically structured, tool-mediated human interaction. Some examples are a family, a religious organization, a school, a discipline, a research laboratory, and a profession" (p. 510).

Central to activity theory of learning is the idea that these tools function to mediate learning of literacy practices (Bruce & Levin, 1997). Students learn to use a range of tools to engage in these literacy practices. Work in the field of "distributed cognition" (Hutchins, 1993) posits that certain practices associated with an activity become embodied or "distributed" in tools. For example, navigational instruments are used to capture what is known about navigating the seas. They then serve as tools that guide a ship based on human knowledge about navigation. Similarly, expert computer systems are built on experts' knowledge about a certain phenomena such as diagnosing a particular disease. Tools are therefore used within an activity to function as extensions of certain practices involved in an activity (Vygotsky, 1978). We turn now to discuss examples of how learning the following literacy practices are mediated through technology tools:

Defining intertextual connections. One basic literacy practice involves defining intertextual links between texts. In defining intertextual links, people define connections between texts in terms of similar images, characters, topics, or themes. Roland Barthes (1970) argues that "Every text, being itself the intertext of another text, belongs to the intertextual...the quotations from which a text is constructed are anonymous, irrecoverable, as yet *already read*" (p. 443).

Students are engaged in making intertextual links in through multi-genre writing about a topic, an approach currently popular in secondary writing instruction (Romano, 2000). Multi-genre writing involves using a range of different types of genres—reports, poems, letters, diaries, stories, advertisements, field notes, photos, drawings, etc. to explore different aspects of and perspectives on a topic. Connecting these disparate genre types requires the ability to determine how different types of texts yield different perspectives on the same topic or phenomenon.

One technology tool that mediates the practice of making intertextual links is hypermedia. Hypermedia functions as a tool by combining hypertext (texts linked together by multi-linear nodes) and multimedia (photos, video, art, audio, text, etc.) to produce an interactive media experience for participants (Jonassen, 2000; Landow, 1997). Because hypertext allows participants to choose optional paths through multimedia, participants can both construct and respond to hypermedia interactively. Students often respond positively to hypermedia texts because it is consistent with their everyday experiences with multi-modal environments that combine images, animation, video, music, and texts (Myers & Beach, 2001).

In an essay about the pedagogical implications of this shift towards hypermedia, Jay Bolter (1998) argues that hypermedia challenges the traditional emphasis in literacy instruction on understanding or producing unified, coherent texts based on a definitive, single perspective. He calls for an alternative focus on teaching a "rhetoric of expectations and arrivals" (p. 10) that help students understand where certain links may take them and how they should respond to where they arrive. And, given the important role of graphic representations in hypermedia, he posits the need for often-marginalized art and video-production instruction to help students respond critically to images.

Producing hypermedia texts using tools such as Storyspace ™, HyperStudio™, HyperCard™, and various web authoring programs, involves defining intertextual links between a range of different types or genres of texts (McKillop & Myers, 1999; Myers, Hammett & McKillop, 1998; 2000). For example, high school students represented their experiences with peers through combining photos, music, video clips, and texts to interpret short stories (Beach & Myers, 2001; http://www.ed.psu.edu/k-12/socialworlds/).

Hypermedia can also assist in organizing links around central themes or topics in writing instruction. Analysis of first-year college writing class students' construction of hypertexts indicated that students structured information around central ideas and illustrated that idea through links to other texts or graphics (Duguay, 1999). Using the hypertext as a tool, helped students define links between diverse parts of their hypertext because the links made it visually easier to connect the ideas.

Researchers have also examined the nature and types of links constructed in hypermedia production, as well as the social motivation to construct these links within the classroom as an activity system. In one study, 16 seventh graders 18 preservice teachers used StorySpaceTM to combine original poems, images, and QuickTime movies to explain the various literacy devices used in poetry (McKillop & Myers, 1999). The types of links employed in the hypermedia productions were analyzed in terms of their functions—an "iconic function" was used to illustrate another text, an "indexical function" was used to extend a text to show shared meaning, and a "symbolic function" was used to question the meaning of a text which resulted in a greater understanding of or a critical analysis of a text. Most of the seventh graders' links served as iconic illustrations of ideas in poems. There were far fewer instances of links reflecting critical analysis, for example, when students juxtaposed texts to generate contested meanings. The undergraduates were more likely to employ links serving a "symbolic function" that involved critical analysis of texts. This study suggests that users employ links for different purposes representing different levels of critical thinking.

Ryan (1999) examined in college students' construction of hypermedia links using HyperCardTM to write a "Literary Journal" biography of an American author based on a range of different sources and information about that author's life, as well as comments on other students' work and supplementary material. In contrast to the essay format that often constrains exploration of alternative, conflicting perspectives, the hypertext format fostered exploration of alternative, conflicted perspectives about an author's life that resisted closure.

Nancy Patterson's (Patterson, 2000) middle school students at Portland Middle School, Portland, Michigan, used Storyspace™ to construct hypertexts based on research on American history and culture (http://angelfire.com/mi/patter/america.html). Students created hypertext narratives with links to information about slavery. As Patterson notes (http://www.npatterson.net/mid.html), working with Storyspace™ shifted students away from simply rehashing information about persons to understanding people and events as shaped by historical and cultural forces.

Posing questions. Another literacy practice involves posing questions related to exploration of issues, topics, concerns, or dilemmas (Beach & Myers, 2001; Short & Harste, 1996; Smithson & Dias, 1996). In teacher/students journal dialogue exchange, teachers pose questions designed to encourage students to elaborate on their answers or explore other perspectives, modeling heuristics for exploring topics. Overtime, students internalize these questions and employ them in their own writing, resulting in increased elaboration in their writing (Peyton & Staton, 1993). Computer-mediated written communication between teacher and student can serve as a tool for teachers to engage in similar dialogue-journal writing modeling of question-asking (Beach & Lundell, 1998).

Adopting multiple voices and perspectives. Another basic literacy practice involves adopting multiple voices and perspectives through making "double-voice" intertextual references or evoking or mimicking the languages or styles from other texts or worlds (Bakhtin, 1981; Knoeller, 1998). Speakers and writers employ these intertextual references to establish social relationships and identities (Bloome & Egan-Robertson, 1993). Through interaction with others, participants construct identities by performing in ways that position them in relation to others' positions–"it is in the connection to another's response that a performance takes shape" (McNamee, 1996, p. 150). As Bakhtin (1981) argued in his concept of "answerability," people's utterances reflect their relationships with others' potential, anticipated reactions to their utterances. In participating with a range of diverse perspectives and voices in a computer-mediated context, students learn to consider alternative perspectives different from their own (Taylor, 1992). The more open students are to experimenting with alternative ways of being and knowing, the more open they are to entertaining alternative values, as opposed to a rigid, monologic perspective on the world (Lewis & Fabos, 1999).

Adopting a collaborative, inquiry stance. In conducting discussions with students, teachers attempt to adopt a collaborative, exploratory stance that serves to invite mutual exploration with students. Adopting this stance requires teachers to balance their status as authority figure with the need to establish a relationship with students. As Deborah Tannen (1984) notes, in this negotiation, participants may use conversation as "symmetrical"--to maintain equal status, or, as "asymmetrical" --to establish a dominant/subordinate relationship. On-line discussions serve to minimize some of the nonverbal aspects creating "asymmetrical" status differences in face-to-face interactions (Walther, 1996). Differences in uses of "asymmetrical" practices may also be related to gender stances. Analysis of college classroom discussions indicated that females were more likely to employ "task-continuative" practices comprised of questions and answers, validation of others' comments, back-channel comments, repetition, extension, supportive laughter, extended development or talk than were males (Bergvall & Remlinger, 1996).

The ability to adopt collaborative, exploratory stance depends on participants' willingness to be open to entertaining others' beliefs as valid and rational, something that what Donald Davidson (1984) refers to as the "principle of charity" (p. 126). As Porter (2001) notes, "because communicators cannot assume shared meanings..., they must assume a shared world; if they assume that they share neither a language nor a world, there would be no possibility for communication" (p. 586). It also requires the ability to frame statements of beliefs or opinions as tentative hunches or hypotheses —what Davidson (1984) refers to as "passing theories" (p. 45). The concept of "passing theories" refers to the idea that participants are willing to modify their established "prior theories" to be open to entertaining and integrating others' beliefs into one's own beliefs (Dasenbrook, 2000). In classroom discussions of literature, when students framed a new topic in a tentative, exploratory manner, other students were more likely to follow up on that topic than when the topic was framed in a definitive manner (Beach & Phinney, 1998). Synchronous computer-mediated classroom interaction in a seventh-grade classroom served to foster students' mutual exploration of tentative ideas and perspectives because they were simultaneously brainstorming together in the same chat site; adopting a hard-line stance was socially unacceptable in this exchange (Beach & Lundell, 1998).

This research indicates that a range of different literacy practices can be fostered through uses of technology tools. This raises the question as to whether technology tools can be used in a teacher education activity system whose object is to foster preservice teachers' ability to acquire and teacher these literacy practices.

Preservice English Teachers' Participation in a Co-Inquiry Multi-Genre Writing Project

This research project examined the question as to how one group of preservice teachers used technology tools to acquire various literacy practices involved in working with middle-school students in a multi-genre writing project.

The participants in this project were 27 preservice English teachers enrolled in a composition-methods course taught by Beach and an instructional technology course taught by Doering in the Fall Semester, 2000 at the University of Minnesota. Preservice teachers [hereafter "teachers"] in the composition methods course learned various strategies for engaging in inquiry-projects and for teaching multi-genre writing. The purpose of the instructional technology course was to help teachers acquire a set of technology tools they could employ in teaching English.

In conjunction with these courses, participants were engaged in a semester-long practicum experience in a magnate middle school that draws students from a wide range of both urban and suburban districts in the St. Paul, Minnesota area. The school curriculum is organized around interdisciplinary inquiry projects in which students are engaged in constructivist exploration of topics across different subjects. The students represented a wide range of socio-economic backgrounds and ability levels, with many students testing at a relatively low reading level. The teachers each worked during weekly visits with one or two students in each of two different class periods.

A multi-genre writing project. The teachers and middle-school students worked together on a multi-genre project involving writing a biographical sketch, a newspaper report, and a narrative about famous people ranging from Martin Luther King Jr. to Princess Diana. They conducted research about their person using the Web and other sources based on questions posed about the person, generating information they used to write a biographical sketch. Students then wrote a newspaper article about some aspect of or even in the person's life employing ClarisWorks to create a news article format. The project concluded with students writing a fictional narrative about their person in which they adopted that person's or another person's first-person point of view to describe some event in the person's life. This required students to imagine the person's subjective experience in an event, along with descriptions of dialogue; setting; and the person's feelings, attitudes, and beliefs about the event.

For the final presentations of their multi-genre projects, the students shared the results of their work in short ten-minute presentations in small groups. Students employed a range of multi-modal presentations acting out a scene from their lives, a skit, interview the person, a piece of art in the person's form; an overhead, slide presentation, news report/sportscast, and dramatic reading.

Hypermedia production. As part of their instructional technology class, the teachers created their own hypermedia production based on their students' multi-genre writing. They used Storyspace^{TM} (Bolter, Smith, & Joyce, 1990) as a tool to develop and link multimedia material within windows that can include or be embedded in other hierarchical windows. (Given the lack of access to computers in the middle school, and the expense of the Storyspace^{TM} software, the teachers, in discussion with their middle-school students, developed the hypermedia versions of the multi-genre writing at their University site. In an ideal situation, the teachers and the students would have developed the hypermedia at the middle-school site.)

Constructing the hypermedia production to share with their students involved a shift in role for the teachers from purveying knowledge to demonstrating their "knowledge by design" (Perkins, 1986). This change in learning when using hypermedia sometimes causes problems as learners struggle to integrate the information they are learning into a hypertext document (Jonassen, 2000). To explore their knowledge as related to their audience, they initially developed concept maps using Inspiration^{TM} to represent their knowledge prior to creating the hypermedia production. These concept maps were used as guides to help the teachers choose what links they believed were important as well as what types of media they may want to employ (graphics, video, sounds) to represent their knowledge in StorySpace^{TM}

The hypermedia productions were analyzed by the investigators in terms of the types of texts—images, written texts, sounds, etc., teachers included in their productions, as well as the types of links they employed in connecting these texts.

Web-based teacher/student communication. As part of a federally funded technology-development program, an asynchronous Web-based teacher/student communication site was created to foster communication between the teachers and students during the time when they were not working with each other in school. To address potential security and privacy issues, pupils would click on the name of their assigned student and then engage in conversation about their projects or personal matters. Only the pupils assigned to the teachers could access those particular teachers. Because the communications were asynchronous, teachers and the middle school students could post and respond to questions relating to their cooperation on the project at any time.

Transcripts of the web-based communications were analyzed in terms of the amount of participation as determined by the number of comments employed, defined in terms of a complete thought unit, a procedure employed by Diane Schallert in her research on on-line communication (Schallert et al, 2001). Each "thought-unit" was also analyzed using a constant comparative method (Glaser & Strauss, 1967) to guide the development of the significant categories and patterns in the data in terms of the types of topics discussed and the literacy practices employed. The types of topics and practices were then crosschecked with an experienced English teacher for further verification (Merriam, 1998).

WebCT bulletin-board discussion. The teachers also participated in an asynchronous discussion on the course WebCT site. For this site, teachers were asked by the course instructor to make at least one posting a week; they were told that they could respond to topics or issues in the course discussions, readings, or practicum experiences, as well as other topics outside the course. The instructor hoped that through participation in this bulletin board exchange, students would gain some experience with uses of a bulletin board as a learning tool for use in their own future teaching. The instructor also hoped that the students would acquire an understanding of how writing is driven by social purposes or needs related to participating in a community constituted through a bulletin board exchange. Transcripts of the WebCT discussion were analyzed in terms of the types of literacy practices employed in the exchanges using the same analysis methods employed with analysis of the teacher/student interactions.

Results

Hypermedia Productions

Development of the initial and following nodes. Analysis of the hypermedia productions based on the students multi-genre writing projects indicated that 80 percent of the teachers began their multimedia development with a picture of the person with links to the "major nodes" or events of the person's life. It was these major events that lent themselves to links where the students explained the person in more detail using various medias. For example, one student studying Martin Luther King, Jr. began their multimedia development with a picture of Martin

Luther King, Jr. with four links underneath the picture to take them to nodes about "Enemies and Resistance," "Awards and Supporters," "Biographical Information," and "Civil Rights Efforts." Each one of these four major nodes had a short written description that explained Martin Luther Kings Jr's relationship to each node. In the "Civil Rights Efforts" node, the teacher developed five sub-nodes that described Martin Luther King Jr.'s efforts. These nodes included "Sit-in Demonstrations," "Passive Resistance," "Montgomery Bus Boycott," "Writings," and "Marches and Speeches." Within each of these nodes, the teacher used images, texts, or clips to represent the civil rights theme. Within the "Writings" node, the teacher listed and included writings from Martin Luther King Jr's books. These writings were obtained through searching the Internet and incorporated within a separate "exploding" Storyspace ™ node. To represent the "Montgomery Bus Boycott," the teacher decided to use a video clip she also obtained from the Internet and to represent the "Passive Resistance" theme; she scanned in pictures that were obtained through a family trip. Teachers integrated a wide range of media texts into their productions, frequently selecting texts most readily available from the World Wide Web.

Other teachers chose to limit their biography to detailed portrayals of a specific period in person's life because information about that period was more available and they preferred to develop a specific aspect of a person's life. As one teacher indicated in her learning log, she would rather research the person's life "using depth, rather than breadth, and develop an understanding that was more meaningful."

Analysis of the links employed. The 27 projects indicated that the most common approach to linking was directly from a picture or words that described themes for analysis placed under a picture. For example, when placing a picture of the "Montgomery Bus Boycott" in a node, a reader would click on the picture to move to an explanation of the boycott and then link back to another node with another theme when finished. Sixty-five percent of the teachers used this approach of simply linking images and texts without use of hypertext links from individual words.

The other thirty-five percent of the teachers used hypertext links in which certain words were linked to other words or texts. One teacher described the life of John F. Kennedy and made links to words that they found most difficult for a reader to outside nodes that either described the word through text, a graphic, or both. The words that were linked were words that the teachers believed would improve the students' reading experience or that they found most interesting. Of the 35 percent that used hypertext links for development, over 80 percent of them had five or more links within each biographical description. The words that were most commonly linked were those that the teacher believed would provide background knowledge for readers assumed to have no previous knowledge of the person. An example is the links in the nodes on John F. Kennedy, which included the "Cuban Missile Crisis," "Bay of Pigs," "Marilyn Monroe," "Fidel Castro," and "Camelot." All of these words were linked to additional nodes that explained John F. Kennedy's relationship to each of these nodes.

Analysis of the media employed. All teachers used digital pictures copied from the Internet or scanned from a book. Thirty percent of the students also used QuickTime movies obtained from the Internet that showed the event in detail. As they indicated in their learning logs, teachers believed that these video clips effectively conveyed ideas they wanted to portray about their person. In addition to pictures and movies, 20 percent of the teachers used sound clips that they prerecorded using SoundEdit Pro ™ or that they captured from the Internet to add narration to their project.

Through these hypermedia productions based on the students' writing, the teachers were using multi-media links to model uses of technology for their students as a tool for portraying a range of different biographical elements of their subjects' lives

Web-based Communications between Teachers and Students

Building personal relationships. Analysis of the web-based communication between teachers and students indicated that the teachers initiated all the comments on the asynchronous discussion board. The initial conversations during the first two weeks of the semester typically began with three-to-five sentence personal anecdotes that served to help establish a personal relationship between the teacher and students. The interaction and writing style during these initial exchanges was relatively formal.

Many of the middle school students described how they enjoyed the ability to communicate on-line to build a better relationship with the teacher before they started the co-inquiry multimedia project. One student said, "because we're able to communicate online, it was easier to get to know the practicum teacher because it gave me more time to think about what I would want to know from them and how I might want to answer their questions." Another student said, "I was always excited to check the discussion area when I got home so I could see if my practicum teacher had sent me a message back." The middle-school students expressed some disappointment to their teachers when the teacher did not respond immediately to their posting, an indication of their interest in hearing from their teacher.

Planning and development. As illustrated by the initial example of work on the Princess Diana project, as the semester progressed, the conversations focused more on planning and developing the multi-genre writing project. While the students normally posed a topic that was directly related to the media and the popular culture, many of the teachers encouraged students to select topics that they found, as one teacher noted, "would be more meaningful and easier to obtain quality information." During these exchanges, the sentences became much shorter than during the initial exchanges, with incomplete one to two sentence responses. The interaction and writing style also became more informal.

The discussion board served to support the teachers and students in sharing ideas about the content of their multi-genre writing project, sharing involving literacy practices such as posing questions. In the exchanges, teachers frequently posed questions to students regarding further elaboration about their projects, questions that they may then have internalized to think about different aspects of their projects.

The assignment of working with two to four students, each of who was creating a different project was a bit overwhelming for the pre-service teachers. The discussion board helped the teachers monitor the students' progress on the project to insure that they completed it on time. Some of the teachers commented on the convenience of being able to send multiple messages to the middle school students and determine their progress through their responses. As one teacher noted, " I am able to keep in constant communication with them up to the days I meet with them. We are then able to get much more accomplished as we have been communicating and know what the plan is when we will see each other."

Frequency of exchange. In the exchanges on the multi-genre project, the teachers were more likely to dominate the discussion. Seventy percent of the conversation focused on direction and control comments where the teachers were guiding the students in their research asking them about the progress they were making on research or reminding them what was due the next time they were able to meet. When responses were elicited on research progress, 85 percent of sharing included Internet addresses where students had found information they believed could contribute to the final project.

Analysis of the exchange based on gender differences indicated that male and female students who collaborated with female teachers had a 35 percent greater quantity of discussions overall than with male teachers. Students were also 52 percent more likely to employ what was categorized as "personal" topics with female teachers than with male teachers. There was also a difference within the student group; female students communicated more frequently and also contributed more project-related information than their male counterpart.

Analyzing all of the asynchronous discussions, teachers employed 73 percent of "thought units," while students contributed only 27 percent. Overall, the focus of the discussions moved from initial personal conversations to project-related conversation during the middle of the semester to personal conversation at the end of the semester.

Given the infrequency of face-to-face meetings during the practicum, this web-based communication served to enhance the quality of teacher/student relationships and provide for frequent collaboration on the project. Through this experience, both teachers and students learned to perceive the value of web-based communication as a tool for engaging in collaborative co-inquiry.

Teachers' WebCT Bulletin Board Communication

Analysis of the topics addressed in the WebCT class bulletin board exchanges indicated that teachers used the exchanges to discuss a range of different issues, particularly those associated with education: teachers as role models, vouchers, censorship, testing, etc. And, teachers shared their experiences with working in the middle-school practicum, as well as personal experiences. In doing so, they employed a number of literacy practices that served to foster productive exchanges:

Display of spontaneous thinking. Teachers used the postings to openly think through a topic or issue, creating a written record of their unfolding thought. Rather than formulate their ideas prior to writing and then write an organized statement, teachers were spontaneously writing out their thoughts in a free-writing mode. They would then entertain alternative, even contradictory perspectives as they formulated their thoughts in a posting. For example, in discussing the issue of teaching expository versus narrative forms to middle-school students, one teacher, responding to another teacher's belief in the value of narrative writing, noted:

As we discussed in class earlier, there is clearly something going on with my middle-school student that makes the narrative form a richer expressive medium for him. I will, of course, take a look at your link. Also, I would like to see more of the research on this. The stuff we've gotten in the program points specifically to class-differentiated processing. But your post suggests that there is also research pointing to a broader conclusion. But before I do I wanted to affirm your idea about narrative processes superseding linear logical processes in decision-making. I know for myself that the work that I do with I am reflecting on a difficult problem often resembles a conversation more than a reasoned, bulleted list. I wonder where conversational dialogue fits in this paradigm? It's not really narrative, but God knows, it ain't logical! Anyway, I shouldn't say more 'til I've read some. More later.

The spontaneous nature of his thinking is evident in the fact that he poses questions to himself ("I wonder where conversational dialogue fits in this paradigm?" which then stimulate him to further thinking about the issue. He also openly reports on the fact that "I shouldn't say more 'til I've read some," implying that he will continue to think further about the topic.

The fact that these teachers explicitly shared *how* they are grappling with an issue provided other participants with a window on the reasoning employed, allowing others to react to that reasoning.

Inviting others' participation. The teachers also commended each other for their comments and invited others to participate or to respond to their postings. The positive comments and invitations implied that they valued the need for others' perspectives as useful, rational beliefs about a topic, an enactment of Davidson's (1984) principle of charity. For example, in discussing the topic of future employment in the job market, one student reacted to another student's description of an interview with a school administrator about her hiring practices:

> I liked what you said here.... First of all, way to ask a relevant questions. Along with finding hope in her answer, I'd like to pose an equally practical question. When and how should we be going about searching out opportunities for our own future employment? I am lucky to have a few friends in high places when it comes to the job-search issue, but I think it would be wonderful to be getting some direction on this subject in class. Anyone else have any insights or information for me???

And, by framing their postings in a tentative, exploratory manner—as "passing theories" (Davidson 1984), the teachers were inviting or implying the need for further verification--agreements or disagreements–from their peers. For example, in discussing the topic of grading writing, one teacher formulated his position on the need to provide feedback during the entire composing process:

> So, my two cents: I kind of see grading as a process that begins when the paper is assigned and ends when we hand back that last draft. Plus, it bears great weight (some insist that grading should be done away with in comp classes) in terms of the whole process, their process, of addressing and completing a writing assignment. Does this make sense to anyone?

In his positing, he hedges his comments with words such as "my two cents" and "kind of see." He also notes that others hold different perspectives on grading. And, his final invitation, "Does this make sense to anyone?" implies that he himself is trying to "make sense" out of his own ideas about evaluating writing. His invitation evoked a number of reactions in which teachers mutually explored the issue of evaluating writing:

Engaging in word/role play. The teachers also frequently engaged in "double-voiced" word play (Bakhtin, 1981), mimicking or parodying persons or discourses. Within the course, the teachers had also participated in a large-group role-play based on the 2000 Presidential election in which they adopted various roles and exchanged written memos with each other. They compared their WebCT exchange with this role-play session in terms of using written texts to engage in verbal play through writing. As one teacher noted:

> The experiences with WebCT has really opened up my ideas on communication and possibilities therein...I think both WebCT and the role play offer something priceless to learning, i.e., play. It's learning of and appreciation for multiplicity. There were so many contexts overlapping in that classroom that multiple uses and abuses are inevitable, and, I think, productive. The same is true for the WebCT.

This dialogic word-play included intertextual references to stances and discourses operating in the group and the teacher education program. By mimicking or parodying the language of these stances or discourses, student were formulating oppositional stances reflecting their own beliefs and ideas about teaching and learning.

Self-reflection on the process. Teachers also explicitly reflected on or described their stances or attitudes adopted in their postings. In some cases, they apologized for repeating themselves, making overly assertive statements, or sharing complaints. For example, one student noted: "Whoops, I just browsed back up the thread and realized I'm repeating myself!" After posting a long message, one student commented, "Sorry to drop such a wide load here on the CT, but it was cathartic." They also valued the fact that they could openly express their opinions within their group without necessarily being concerned about offending others. One student noted, "could you just imagine if we were afraid of speaking our souls for fear of offending someone. Our class would be pretty damn quiet if that were the case."

A Korean student noted that the site served to foster development of open expression, something she finds lacking in her Korean student peers: "we are too concerned about hurting others people's feelings to think out loud... I think Korean students have to learn to be more assertive in order to exchange their thoughts."

Teachers also noted some of the difficulties specific to participating on a bulletin board discussion. One teacher commented on the difficulty of conveying her attitudes: "I don't know exactly how or why, but threaded discussions transform words. Unless the writer is incredibly skilled, the tone is hard (if not impossible) to communicate. Perhaps it is the instantaneous nature of it that is its main draw and downfall...? Her comment suggests that some participants had difficulty communicating their attitudes in the exchanges.

The teachers therefore used their exchanges on the WebCT bulletin board discussion as a tool for mutually formulating strategies for coping with various issues associated with teaching. Through their participation in these exchanges, they were learning to employ computer-mediated communication as a tool for the literacy practices of displaying spontaneous thinking, inviting others' participation, adopting an exploratory stance, engaging in word/role play, and reflecting on the process.

Summary

The results of this study indicated that the teachers and middle-school students were employing the technology tools of hypermedia production and web-based communication to engage in literacy practices involved in their multi-genre writing project and in communicating with each other. These tools served to mediate the uses of various literacy practices within the larger activity system of teacher education, whose object is to assist teachers to acquire those practices involved in working effectively with students.

The teachers used the Inspiration™ and Storyspace™ tools to define intertextual and hypertextual connections between the texts included in their multi-genre writing project. These hypermedia tools allowed teachers to combine written texts, images, sounds, and video to portray the characteristics of a person in a web-based production for sharing with others, including their students. Creating these hypermedia productions in a co-inquiry project with their students also helped teachers learn how to model the literacy practices of making intertextual or hypertextual connections for students, an important teaching strategy.

With the increased focus on multi-media and hypertext communication in literacy education, English/language arts teachers need to acquire an ability to use this tool as part of their literacy instruction. Teachers also need to be able to employ links that go beyond just illustration to engage in critical interrogation (McKillop & Myers, 1999). One limitation of this project remains the relatively high cost of the Storyspace™ software for large-scale use in schools. At the same time, other, less expensive hypermedia software such as Hyperstudio™ or HyperCard™ can be used as an alternative.

The teachers and students used the web-based communication site as a tool for establishing social relationships and for planning their multi-genre writing projects. This site provided teachers with continuous, on-going interaction with their students, something often lacking in practicum experiences with infrequent school visits. The students expressed a high level of engagement with this site, expressing disappointment when they did not receive responses from their teachers. The written exchange allowed teachers to model a range of literacy practices, particularly self-disclosure about their own lives and posing questions about the project, practices students then demonstrated in their own responses.

One problematic aspect of the exchange was the fact that the teachers dominated the interactions by a ratio of four to one. One possible explanation of this disparity was that the students had minimal access to computers in their school and simply did not have the time to write extensive answers. While students could also access the site from their homes, many students did not have computer access in their homes. Another factor may have been that some students had minimal writing skills; limiting the amount they were able to write. The fact that the students wrote longer entries when they were discussing their own lives and shorter entries when they were discussing their projects suggests that teachers employing this tool need to include a focus on autobiographical topics, as well as topics related to tasks. There were also marked gender differences, with female teachers eliciting more participation from students than male teachers through uses of "personal" connections, suggesting the need for teachers of both genders to employ such connections.

Through their participation on the WebCT bulletin board, teachers were recognizing how participating in an active, on-line community helped them explore issues and concerns related to education. Given this experience, they may then be more likely to participant in similar web sites or employ such sites in their own teaching. And, through that participation, they were employing a number of literacy practices that they could model as participants in teacher/student web-communication.

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A Themed and Collaborative Approach to Teaching Computers and the Internet

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This research series is a practical and effective approach to exposing middle- and high- school students to fun and useful elements of the Internet, current technology issues and to Microsoft Word, Excel and PowerPoint. The theme for the learning series is one in which the students are owners of music recording companies. Youths are fascinated by careers in the recording industry! The focus of this theme is not on the musical talents, but on the professionals who run these organizations.

The Program Community

The 6-month bi-weekly Saturday program was sponsored by the 100 Black Men of Atlanta under their Project Success initiative. Project Success is a program that allows inner-city middle- and high-school students to be mentored by members of 100 MBA and volunteering college students. The Project Success students and their parents have to be actively committed to the entire program, which includes participation in workshops, training, and cultural events that are designed to teach the students to be productive, progressive, members of society. For each student that stays committed throughout his or her middle- and high-school career, the 100 BMA pledges to pay the full tuition for any college to which the student is accepted. The program is a long-term commitment for everyone involved, including the students' guardians. The 100 BMA are currently into their second round of students to reach college age.

The program community consisted of one instructional designer (me), One instructor (me), approximately 5 undergraduate student volunteers and two groups of 16 – 20 students. The volunteers, each whom had technical experience, floated around the classroom offering help to students who needed it and helped to keep the noise down when the students got a little excited.

The students were broken into two groups. For the first two hours of the half-day program, half of the entire group would work with me and the other half would participate in another part of the program. At the end of the two hours, the two groups would switch activities. The groups were assigned arbitrarily.

The Program Theme

During my volunteer time with Southeastern Consortium of Mathematicians and Engineers (SECME), I found that many – if not most – of the students that we visited wanted to pursue a career in acting, modeling or the music industry and the heaviest concentration was in the latter. I decided from the start to use a theme throughout the program, to put the students in the center of the learning, and to bring about reinforcement. I decided the theme would be that of the recording industry to provide interest and familiarity for the students. Though the theme encompassed the idea of the recording company, the focus of the theme was not on the musical talents, but on the professionals who run the companies. I wanted the students to be in positions of authority.

In each scenario within the learning series, the students were cast as recording company executives who needed to accomplish a particular task for the business. A list of objectives or tools needed to accomplish the task was also included. The instructions that followed the scenario and objectives, which required the use of one of the applications addressed in the program, helped them to accomplish those tasks. I included actual screen captures in the notes, which allowed the students to know exactly what they should see on their screens and it enabled them to work ahead if they liked.

Curriculum format

The objective of the Saturday technology sessions was to expose the students to fun and useful elements of the Internet, current technology issues, and Microsoft Word, Excel, and PowerPoint.

Module 1 – Program Introduction

The first module began with student, volunteer and instructor introductions. To bring cohesiveness, consistency and relevance to the program activities for the students, a general theme for the activities was introduced. Two members of local recording companies were invited and were present to give the students an idea of the importance of computer and technical knowledge in the industry. They also answered a barrage of questions about various facets of the recording industry.

During the module, the students also took a pre-test on the various components of the computer. They were then shown actual internal components of a computer and told of their functions. Finally, they were given a verbal overview of what the entire program would entail.

Module 2 – The Internet

Unit one of the second module included a PowerPoint presentation on the history and current state of the Internet that included definitions, information search techniques and emailing instructions. The students were then lead to the computer rooms where they all were assisted in setting up their own email accounts. They also participated in a World Wide Web scavenger hunt. The scavenger hunt consisted of questions that varied in difficulty. The students were asked to use any of the various search techniques that were introduced in the presentation to find the answers. Once a student found an answer, the student was asked to show the class how that answer was found and received a treat.

Unit two involved more in-depth Internet searching by the students. The students were asked to find three types of websites: recreational, reference and consumer. They were instructed to find three websites for each category (for a total of nine websites) and to give a description of each. The students were then asked to volunteer to share the websites they found. The reports were collected so that a list could be compiled and distributed at a later date. The students were also given a post-test on the components of the computer.

Module 3 – Microsoft Word

The first unit of the third module focused on an introduction to Microsoft Word. The students took a pre-assessment regarding their knowledge of MS Word and received instruction on creating a flyer for their recording company's annual talent show.

The second unit included instruction on creating a research paper in MS Word. The activity was introduced as a report for the recording company CEO about the Internet and web publishing. In the scenario, the report occurred as a result of a suggestion by an executive (the student) about creating a website for the company. Afterward, the students took a post-assessment on their knowledge level with MS Word.

Module 4 – Current Events in Technology

The fourth module consisted of a discussion on the importance of technology. The students were arranged in groups and asked to brainstorm about benefits of having access to a computer and the Internet. The students were also introduced to the highlights of a report called *Falling Through the Net: Defining the Digital Divide* (www.ntia.doc.gov/ntiahome/fttn99). The report, based on the December 1998 U.S. Department of Commerce Census Bureau data, provides an updated snapshot of American use of technology. The report identified that computer ownership and Internet access has increased for all ethnic groups in all locations. Unfortunately, though, groups that were already connected are now far more connected, while those with lower rates of access have increased less quickly. As a result, the gap between the technologically wealthy and the technologically poor is growing. This gap is known as the "digital divide". The report also revealed that there are many factors that create the huge difference between those who have computers and Internet access and those who do not. The children discussed in groups and with the class several ways to provide solutions to the problems.

Module 5 – Microsoft Excel

The fifth module included a pre-assessment and an activity to introduce the students to Microsoft Excel. The activity was presented as scenario regarding record sales for the various recording label artists and the overall recording company. The students created a spreadsheet and accompanying charts and shared their end results with the class. A post-assessment followed the activity.

Module 6 – Microsoft PowerPoint

Unit one of the sixth module began with a pre-assessment on PowerPoint. The students participated in an activity that allowed them to create a promotional PowerPoint presentation for their company's new artist event. In the scenario, the company executive would design the presentation to attract interest and place it on a computer in the student center of a local university.

Unit two provided the students with an opportunity to develop a presentation of their own. The students were asked create an original presentation that included autobiographical information and a 3-, 5-, and 10-year plan for the future. The presentation was also to include family pictures that were scanned into the computer, digital pictures taken in class and graphics imported from the Internet. The students received instruction on visual consistency and quality presentation design.

The third unit of the sixth module began with presentation tips such as eye contact and annunciation. The students were given the opportunity to practice, present to the class and receive feedback. The unit ended with a post-assessment on PowerPoint.

The fourth and final unit consisted of presentations by the students. The students were encouraged to invite their parents to observe the presentations. Sponsors and mentors of the program were also encouraged to attend.

Program Conclusion and Assessment

The program concluded with an opportunity for the students to demonstrate their ability to use the technology through a well-attended voluntary presentation at an assembly for parents and program sponsors. Evidence of the effectiveness of the instruction was provided through a statistical comparison of the pre- and post-tests, as well as comments of interest, excitement and approval from several of the program students, their parents, and Project Success volunteers and employees.

Jonassen's Seven Aspects of a Technology Integration Learning Environment

According to Jonassen (1999), technology integration does not happen in a particular location, but in a particular learning environment. That environment includes a learner-centered-teacher-as-facilitator atmosphere and seven additional aspects that make the learning meaningful. The learning environment is active and requires students participate in the processing of information; it is constructive, so students are encouraged to integrated new ideas into their prior knowledge; it is collaborative, which allows students to work in learning communities; it is conversational, so that students share ideas and build upon each other's knowledge; it is contextualized or situated in real world task or problem-based activities; it is intentional, and students are made aware of cognitive goals and objectives at the onset; and it is reflective, where students are encouraged to reflect on the process and articulate what they have learned.

The overall theme of the technology learning series was that of a recording company in which the students were corporate executives acting on behalf of the company. Each of the seven aspects was present within the instruction produced for the program. For instance, with their prior knowledge of and interest in recording companies, students were able to put the new information regarding the software applications into context; students were assigned ownership of their recording companies and were given positions of action and authority within the business. They were also allowed to choose an "executive board" of three to four members. This allowed them to learn in teams. The team atmosphere allowed the students to share ideas and construct the knowledge-building communities. The modules began with a scenario that put the instruction into a real-world perspective for the students and each scenario was followed by a list of objectives for the instruction, so students were made aware of the concepts that were to be learned. Many of the modules also ended with an opportunity for the students to share their projects with the other teams, talk about their process, and answer questions asked by the instructor and other students.

Lessons learned

There were several valuable lessons that I learned while participating in this technology program, most of which had nothing to do with the technology itself. Most had to do with the relationships and dynamics of the classroom.

Use a title with your name in the beginning

First, I would have asked them to call me Ms. Teshia. I did not do that at first because most of the adult volunteers were addressed by their first names and I wanted to "fit it" but what I failed to realize was that those kids had long-term intimate relationships with those people that made it appropriate. I had not established myself in the community and had not earned the respect of the students, so I was placing myself on the peer level with them instead of earning my position. If I had it to do again, I would have asked them to call me Ms. Teshia and considered allowing them to do otherwise once we grew our relationships. It is very hard to go the other way.

Include plenty of conversation and break time for students

Break time was the time when I got to know the kids of personal levels, when they got to know me, and when they got to fellowship with each other. I suggest taking plenty of breaks. You can get them to stay on task if they know a break is coming up soon. Also, since the program is not compulsory, it should not feel like hard work and school, but fun like computer camp. This was also a time when I got a chance to truly learn about the likes and dislikes of the kids' generation, which informed my design of the activities.

Allow the use of home language at times

Home language should be permitted in the classroom in certain situations. I allowed them to talk amongst themselves in a way that is comfortable to them but not offensive to anyone. They even communicated with me in a respectable manner in a form of their home language. However, when it came time to present, they were asked to use Standard English. Presentations were voluntary, and they knew by volunteering, they would have to present using Standard English. Most were more than compliant.

Place no labels or stereotypes on the students

Even though you have to try to find out all you can about the students before the course in order to design the instruction, do not associated the students with labels as a result of that inquiry. It can prove to be harmful the their self-images and counter-productive to the instruction.

Use small groups

The kids flourished in small groups! Students brainstormed and named their recording companies, and many of the groups even designed a logo and assigned rolls within the recording company.

Make certain the theme has relevance for the learners

It was so important to have lessons that had relevance to the students because they embraced the learning. They saw immediately how they could use that new knowledge and they wanted to learn.

Include group policy making at the start of the program

It became necessary towards the middle of the program to establish some rules of behavior. The program was voluntary, so there were kids who came every session and those who came every once in a while. There were also those who behaved very well and those with whom we had challenges. We has instance where our group disrupted others in the building and times when a few members the program disrupted other members. So we had to come up with rules that the kids understood and embraced. We decided to include the students in developing a list of acceptable and unacceptable behavior and the consequences of both and had them sign it. It curtailed many behavioral problems. In retrospect, I would have done that much earlier in the program and I would have kept a student signed copy and sent home a copy that had the student's signature for the parent to sign and return, just to cover all bases.

Conclusion

The themed and collaborative approach to teaching computers and the Internet worked well because the program was a community effort and there was a consistent theme throughout the program that engaged the students and gave meaning and practicality to the content. Each of the modules included screen captures and collaborative activities, which allowed the students to work at their own pace and communicate understanding of the content with group members. Jonassen's seven aspects of a technology integrated learning environment certainly informed the design and implementation of the themed series, but group policy making, frequent breaks, and an absence of stereo types of the students were instrumental to the success of the learners.

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Defining and Ensuring Academic Rigor in Online and On-Campus Courses: Instructor Perspectives

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Abstract

This study attempted to define what academic rigor means to the faculty members and graduate assistants who taught on-campus and online courses at a major Midwestern state university. The study sought to discover the level of importance these instructors gave to academic rigor and what strategies they used to ensure academic rigor in their courses. Finally, the researchers asked instructors about their strategies to ensure academic rigor in these two different delivery methods.

Introduction

Academic rigor is a topic that resides at the very core of the traditional conception of the academy. While precise definitions (Winston et al., 1994; Braxton, 1993; Nicholson, 1996) may vary, the basic idea is central to postsecondary education as it has been implemented in the past few hundred years. However, at the dawn of this new millennium, the popularity of new pedagogical beliefs and instructional strategies, such as constructivism and problem-based learning, and delivery methods, such as online distance education, make it clear that it is time to review our conceptions of academic learning and to see if old definitions match the postsecondary educational practices of the new millennium.

The amazing growth of online distance education, in particularly, heightens the need for this type of study. As enabling technologies such as computers and the Internet have become more ubiquitous in the U.S., distance education programs have become increasingly popular in both formal academic settings as well as corporate settings. Specifically, over the past five years there has been a move by many institutions of higher education to provide some kind of online learning opportunities. According to a recent MSNBC report (McGinn, 2000), 75 percent of all U.S. universities now offer online coursework, and 5.8 million students have taken online college courses. This rapid movement towards offering online courses has caused some concern, especially in academic communities, regarding the wisdom and implications of this trend. One of the concerns that is often voiced (Phipps & Merisotis, 1999; Rutmania, 1999) implies that online courses are not as academically rigorous as traditional face-to-face courses. If this is truly the case then the academic reputation of the institution could possibly be at risk.

This study attempted to explicitly define what academic rigor means to the faculty members and graduate assistants who taught on-campus and online courses at a major Midwestern state university. The study also sought to discover the level of importance these instructors gave to academic rigor as they designed their course offerings, and what strategies they used to ensure academic rigor in their courses. Finally, the researchers asked those instructors who taught both online and on-campus courses about their strategies to ensure academic rigor in these two different delivery methods.

Research Questions

This research study attempts to answer three primary questions:

How do instructors define academic rigor?
How important is academic rigor to these instructors?
What strategies do these instructors use to ensure academic rigor in their on-campus courses?

For those instructors who teach both on-campus and online, what strategies do these instructors use to ensure academic rigor in their online courses? Are these strategies different than the strategies used in their on-campus courses?

Our hypotheses going into the research were that instructors would have a variety of definitions of academic rigor, but that important similarities would emerge, and that the differences in definitions would also be of interest. We assumed most instructors would view academic rigor to be of great importance in their course design.

We thought that instructors would have a variety of strategies for ensuring academic rigor and that, again, we would find a core group of strategies, with interesting variations to report as well. Our hypothesis regarding the difference between ensuring rigor in online and on-campus courses, based on informal conversations with instructors of both types of courses prior to the research, would be minimal, and that similar strategies, though obviously influenced by the medium used to deliver the course, would be employed.

Significance of Research

There are many reasons why this research is significant to instructors and administrators at postsecondary institutions, especially those institutions embarking upon distance education initiatives. Three key areas of impact are described below.

Evaluation and improvement of current on-campus and online courses

Most instructors, we feel it is fair to say, would agree that there is a need for the continual evaluation and improvement of their course offerings. If our hypothesis that academic rigor is important to instructors is correct, then our findings relating to the first research question should provide some clear criteria regarding academic rigor which then can be used to evaluate the extent to which it exists in current course offerings. Additionally, the findings of the third and fourth research questions will most likely shed light on specific strategies relating to academic rigor in on-campus and online courses that can be focused on to improve the academic rigor of both types of courses.

Promoting discussion of academic rigor among faculty

We hope that the results of the research will help to promote discussion of academic rigor and related pedagogical issues among faculty. By reading about others' strategies for ensuring academic rigor, they may be moved to discuss these strategies and their own with their colleagues.

Providing an opportunity for distance educators to share their beliefs about, and strategies to ensure, academic rigor

Any study that looks at the concept of academic rigor and does not also discuss it in the context of online distance education is doing a disservice to its readers, given the prevalence of these courses today (McGinn, 2000). Distance educators have been accused of providing less-than-rigorous courses voiced (Phipps & Merisotis, 1999; Rutmania, 1999) and we wish to give them an opportunity to dispel these notions, if they are indeed incorrect in the eyes of the instructors involved.

Past Research

Our review of the relevant research shows that the topic of academic rigor is mentioned throughout the literature, but that only in a fewinstances is the meaning of the term specified. We were only able to find three cases in which the term academic rigor was explicitly defined in some way. Below we include the three different definitions. Being that the concept is a complicated one, rather than trying to restate and summarize the elaborate definitions we encountered, and risk losing some of the authors' meaning, we will present below three of the best definitions that we found in their entirety.

An environment that is intellectually challenging and demanding. Students perceive a norm of excellence and responsibility, which is expressed through high, but realistic, evaluation standards. The class is seen as fast-paced, and there are expectations that students will invest considerable energy and time in completing assignments (Winston et al., 1994)

Academic quality is manifested in such course-level academic processes as the type of questions faculty ask students during class, the nature of term paper assignments or other written exercises. (…) [AR is] the level of understanding of course content to be demonstrated by students while engaging in these course-level processes. (Braxton, 1993)

Rigor—focused and critical work—arises from a sense of the importance of subject matter and the opportunity presented for its mastery and refinement through study. (…) In a rigorous academic environment, the purposes, principles and methodologies of scholarship as a means of establishing the connectedness of things is understood. (Nicholson, 1996)

All three of these definitions have different foci. While Winston's definition focuses on student output and perception of a course, Braxton's definition focuses on the instructor's efforts as well as the learning outcomes of the course and Nicholson's definition centers around a more traditional awareness and use of methodologies.

Although most of the articles that referred to academic rigor did not explicitly define the term they often had embedded within the text phrases that have helped us to gain a better feel for what they meant by academic rigor. Table 1 has a list of key phrases relating to academic rigor from some of the articles that were reviewed. It is important to note that despite the fact that academic rigor is used in many different ways, it is almost always referred to as being a positive attribute that a program or course should have under ideal circumstances.

Reference	Terms
Ridley et al., 1998	"course achievement as measured by grades" "concern that instructors have applied comparable standards in assigning grades to their online or traditional students"
Snell et al., 1999	"Online or distance learning is harder than offline or traditional classroom learning" "it appeared that online courses were more rigorous" "less withdrawals and failures among the traditional offline group"
Thomas, 1998	"academically challenging" "number of homework assignments"
Kerr, 1990	"Depth of study in areas such as foreign languages and mathematics" "Quality: Four or five academic subjects each year" "Balance: Evidence that the student took a broad curriculum" "Trends: Evidence as to whether the student's grades are gradually improving each year"
Rossman et al., 1996	"increased requirements" "more rigorous content standards" "students maintain a specific grade point average" "more challenging program of study" "taking more courses" "taking more challenging courses" "taking more course breadth"
Taylor et al., 1991	"critical thinking" "mastery of a body of facts" "development of writing skills" "acquisition of library and research skills" "substantial reading and writing assignments" "analysis and interpretations of primary sources" "assignments that foster critical thinking and interpretative skills"
Niles et al., 1990	"liberal education" "equip individuals with the skills and understanding necessary to perform their duties"
Bursuck, 1994	"educational rigor" "higher standards" "increased accountability" "higher expectations for student performance" "assigning more homework to students"
Roundtable, 1997	"academic rigor demanded by the national curriculum" – content coverage? Skills vs. knowledge outcomes in curriculum
Hayes, 1997	"the ultimate test of the student's academic preparation and intellectual ability . . . comes at the time of university admission exams" "academic standards" "academic demands" "scholarship and academic excellence" "academic achievement" "academic effort"

Table 1. Key phrases related to academic rigor from the literature.

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Craig Nelson, a Biology professor at Indiana University, spoke at Indiana University's 18th Annual Spring Symposium, *Listening to Learners: Creating Contexts for Student Success*. The title of his presentation was "How We Defeat Ourselves: Dysfunctional Illusions of Rigor." Although his talk did not directly address what academic rigor *is*, it shed light on the subject by addressing what he felt academic rigor *is not*. The illusions of rigor that he presented expressed the idea that rigor is not:

- Hard courses that weed out weak students
- Avoiding "pampering" students (e.g., giving them flexibility etc.)
- Covering more content (Nelson, 1989)
- The difficulty of the exams

(Nelson, 2000a)

In an article (1997) entitled "Tools for Tampering with Teaching's Taboos," Nelson promotes the importance of "critical thinking" in the college classroom. He provides several methods or tools for getting students to think critically about what they are learning.

Methodology

The goal of the research was to answer the research questions outlined above. The following general steps were taken in this effort.

The first step of this phase was to determine how other individuals and institutions have defined academic rigor, by conducting an exhaustive review of the past research in this area. Because of the variations of academic rigor, and the fact that the concept was often referred to under different names, this research effort was quite challenging.

The findings from the literature review were used to inform the questions that were asked in an initial set of interviews of a purposefully chosen group of instructors at the aforementioned large Midwestern state university. These instructors were chosen from throughout the university's many schools and departments (see Table 2). The purpose of this initial data gathering was to acquire a larger body of information regarding academic rigor from which more targeted and precise questions could be created for the final survey.

In addition to the demographic information presented in Table 2, it is important to note that of the instructors interviewed for this study (n=8), 2 were full professors, 3 were associate, visiting or adjunct faculty, and 3 were advanced graduate students serving as associate instructors. Of this group of instructors, 3 had taught online as well as on-campus, and thus our findings for question 4 will be based on responses from these instructors.

Department	Gender	Years Teaching Online	Years Teaching On-campus
School of Nursing	Female	2	12
Leisure and Recreation	Male	0	3
Biology	Male	0	34
English & School of Continuing Studies	Female	0	3
Telecommunications	Female	0	5
Language Education	Male	2	5
Curriculum and Instruction	Male	0	25
Instructional Systems Technology	Female	3	5

Table 2. Demographic information about interview participant

The questions posed of our interview subjects were as follows:

- What is your personal definition of academic rigor?
- How important do you feel academic rigor is? Why?
- What do you do to ensure academic rigor in your courses?
- Do you do different things in your online courses compared with your on-campus courses to ensure academic rigor? If so, what?

The final step in our research study procedure was to review and summarize the data collected through the interviews. Similarities and differences in the perceptions related to academic rigor were noted.

Findings

Definition of Academic Rigor

What it *IS*	What it *IS NOT*
critical thinking	not grades
high standards and expectations	not memorization
process more than product	not regurgitation
cognitive development	

Table 3. Common responses to the academic rigor definition question

What it *IS*	What it *IS NOT*
norm referenced	not time based
content coverage	not giving lots of tests
gatekeeper of academy	not lots of people who fail
scholarship/peer review	
student involvement	
pushing students beyond comfort level	

Table 4. Interesting but uncommon responses to the academic rigor definition question.

Our analysis of the interview data related to the definition of academic rigor developed into a two separate listings: of common responses to what academic rigor was and was not (Table 3), and interesting but less common responses to the question (Table 4). Given that the responses to the question had such interesting variations, we felt it was necessary to report them, especially given that survey data might potentially find that the alternate definitions might be held by a significant number of respondents.

The Importance of Academic Rigor

Based on our interviews with faculty members, we found:

- As expected, all participants agreed that academic rigor is important
- Two instructors said that its importance varied depending on the level of the course (e.g., rigor was more important for higher-level courses)

Methods for Ensuring Academic Rigor with On-campus Courses

After analyzing the data from our interviews with faculty members, we found a diverse collection of strategies that nonetheless seemed to fit well together. We divided these strategies into seven categories, with one or more strategy associated with each category. Unfortunately, it is beyond the scope of this study to go into specific details about how each strategy should be implemented, but hopefully this list of strategies should be of benefit to online educators.

Expectations:
- Make expectations clear
- Make expectations high
- Make grading criteria explicit

Selection of Readings:
- Provide high quality readings/texts
- Provide materials a step above students' level
- Provide a variety of materials

Critical Thinking:

- Require and support students' efforts to examine multiple issues from multiple perspectives
- Require students to cite the readings
- Require student reflections

Modeling:

- Model good scholarship
- Model rigorous thinking

Support:

- Provide appropriate scaffolding for learners

Discourse:

- Ask questions that encourage thinking about relationships and not memorization

Assignments:

- Create challenging assignments
- Create assignments that require higher cognitive processes
- Design authentic and realistic projects and problems for the students

Methods for Ensuring Academic Rigor with Online Courses

Based on our interview data, we found that, in general, similar methods for ensuring academic rigor seem to be used for online as well as on-campus courses, which means that the list directly above should be relevant also for online courses. However, some instructors did note some differences in their teaching methods related to academic rigor in the online delivery method. Some instructors felt that, in their online courses, they:

- Put more demands on students because of the absence of feedback from face-to-face contact
- Structured online discussions more carefully
- Made expectations even more explicit than they did with on-campus students
- Expended more effort to get feedback from students

Interestingly, one instructor went on to say that *if* content coverage was equated to academic rigor then:

- The same methods will work online as in the classroom
- The online course can be more academically rigorous than the on-campus course because of up-to-date resources

However, he stated that, in his mind, rigor was not the same as content coverage, and that other things, such as the quality of instructor-student and student-student interaction, were as important, if not more so, than merely providing specified content, and thus required different strategies for online delivery. He did not, unfortunately, specify these differing strategies.

Rigor, Difficulty, and Support

One of the faculty interviewees, Craig Nelson, has been nationally recognized for excellence in teaching at a post-secondary level. Nelson (2000b) provided some insights related to academic rigor that we feel are particularly relevant to the online delivery of courses.

His first observation was that oftentimes faculty and students have a false conception of what academic rigor is. We often confuse the *rigor* of a course with the *difficulty* of a course. He claimed that a more accurate synonym to describe academic rigor would be the word "*challenge.*" It was insightful for us to think of academic rigor or academic challenge as having the following relationship with course difficulty and the support provided to the distance students. Nelson (2000b) related these three factors using the equation in Figure 1.

$$\boxed{\textbf{Difficulty} = \frac{\text{Academic rigor}}{\text{Support}}}$$

Figure 1. Relationship between course difficulty, academic rigor and student support.

This helps us to understand that the difficulty of a course is inversely proportional to the support that students are given. Thus the difficulty of a course increases as the support for the students in the course decreases. Similarly, the difficulty of a course could be low and the course could still be academically rigorous if adequate and appropriate support is provided to the students.

This understanding of the relationship between *difficulty*, *academic rigor*, and *support* is particularly important in a distance learning environment because of high dropout rates. Students are more likely to drop out of a distance program as the courses become more difficult and exceed the students' ability or willingness to persevere. Instructors teaching distance education courses, Nelson (2000b) argues, should maximize the challenge that a student experiences but not the difficulty that a student experiences trying to meet that challenge.

Limitations

It must be stated at this point, that, even though our findings from our interviews were quite interesting and potentially quite useful, they are based on quite a small sample size (especially research question 4, which was answerable by less than half of our already small sample, who taught online as well as face-to-face). Another important limitation is that the sample only included faculty from a single institution.

Conclusions

The purpose of this study was to gain a better understanding of academic rigor in online and on-campus postsecondary education. In order to do this accurately, the researchers attempted to define factors that instructors understood "academic rigor" to consist of, as well as quantify how important academic rigor is to these instructors. Information about strategies used to ensure academic rigor in online and on-campus courses was also gathered.

While the results reported in this report are based on a very small sample size, the findings are promising, and the researchers feel that this study will be of great interest to both on-campus and online educators and administrators interested in ensuring the academic rigor of their courses.

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Kids as Airborne Mission Scientists: Designing PBL to Inspire Kids

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Problem-based learning (PBL) has great potential for inspiring K-12 learning. KaAMS, an example of PBL, was designed to help teachers inspire middle school students to learn science. The kids participate as scientists investigating environmental problems using NASA airborne remote sensing data. This paper provides an overview of the instructional design challenges in creating web-based PBL teacher support materials, the PBL model we selected, the activities embedded in the PBL, and initial results of classroom trials.

Introduction

Kids can be motivated and inspired by making direct contributions to solving real scientific issues. Can teachers be inspired too? Through a PBL approach, KaAMS, a NASA funded project guides teachers to take middle school children on live and past NASA airborne missions to collect data to study two environmental issues. The ultimate mission of the project was to inspire kids to learn and develop a career interest in science, math, technology and geography by their participating as scientists in activities punctuated by "bursts" of interactive events culminating in the analysis of data from NASA airborne missions. The mission is accomplished by providing resources to teachers to use with middle school children. To do this, we developed two problem based learning modules addressing two different environmental issues—active lava flows and coral reefs in Hawaii. The modules consisted of new *lesson plans* that could be used flexibly by many teachers, and that use *existing* NASA and other web resources. The goal was to harness those resources that exist rather than create totally new ones.

Problem-Based Learning Literature—the basis for KaAMS

The conceptual framework of problem-based learning model for KaAMS is based on the perspectives and implications of problem-based learning literature. Problem-based learning as an instructional model associated with the new learning paradigm (e.g., Reigeluth, 1999) has been implemented in diverse content domains such as medical education, business education, social education, and science education. Problem-based learning, in general, encourages students to engage in learning activities to solve a real world problem (Duffy & Cunningham, 1996). According to problem-based learning researchers (Barrows, 1986, 1992; Savery & Duffy, 1995; Schwartz, et al, 1999), key characteristics of problem-based learning include the following;

- Real-world problems with a motivational context to drive learning. A real world problem is used as a stimulus for authentic activity.
- Given a problem space, students generate their own learning goals in terms of what they will attain.
- Multiple learning resources including print, electronic and humans are provided for the student to develop a deep understanding about content knowledge related to the problem and apply that knowledge into the problem solving activities.
- Students as active problem solvers work with their peers, teachers, and experts to share their different perspectives and develop deeper knowledge on a subject area.
- By placing students in learning by doing situations, students develop a disciplinary knowledge base, problem solving skills, reflective thinking skills, and collaboration and communication skills.
- Teachers play a role as coach or facilitator that supports students' learning and problem solving activity, rather than directly teaching what students should know and how students should solve a problem.

In general problem based learning (e.g., Barrows, 1986, 1992; Savery & Duffy, 1995; Schwartz, et al, 1999), students engage in the following five stages of a learning process:

- *Present a problem*—Students start with a presentation of a real world problem.

- *Generate what students know and what they need to know*—Students actively define problems and generate what they know and what they need to know based on their prior knowledge and experience. They are encouraged to identify learning issues or knowledge necessary to construct an understanding about how to solve problems.
- *List possible actions*—Based on the previous activity, students discuss and come up with strategies and activities for solving the problem.
- *Collect and analyze information*—All students engage in gathering information from available learning resources ranging from print-based materials, electronic and human resources and from the designated facilitator. After gathering the information, they analyze and evaluate information in terms of what is most useful or what is not useful to solve the problem. They discuss and negotiate their perspectives about alternative solutions with peers, their teacher, and experts.
- *Present and share solutions*—They finally propose their solutions, share them with their peers and experts who might provide different perspectives to the solutions, and revise their solution based on feedback from their peers or experts.

The KaAMS Model

From these perspectives and implications of the problem-based learning literature, we developed the KaAMS problem based learning model with four learning stages in which middle school students engage: 1) problem scenario, 2) propose ideas/search information, 3) conduct mission/collect and analyze data, and 4) propose solution. Each learning stage of the KaAMS problem based learning model includes the following key attributes:

- Authentic, ill-structured problem situation
- Assumption of roles by the students
- Reflections about what they know, what they need to know
- Planning the investigation procedure
- Access to rich NASA web resources
- Active investigation
- Learning activities situated within real NASA missions
- Reflective thinking exercises
- Peer and expert collaboration
- Learner activities/tools in interpreting data gathered
- NASA scientist support
- Shared solutions with peers and experts

Conceptual Framework for KaAMS

Foundation of KaAMS

Conceptually, the KaAMS framework, as shown in Figure 1, is built upon the premise and foundation that among all NASA web resources from all aspects of the agency, a multitude of resources can be used in the classroom. These resources are filtered through a second-level premise, which is the Web-Enhanced Learning Strategies (WELES) interface. This interface helps to sift through the available resources for elements and composite sites that are appropriate for use by middle school teachers and students. These resources are then used in four parts of a lesson plan—frame/inform/explore/try. The third premise is that teachers can use real web resources from real NASA missions in a problem based lesson format. Finally, these three levels of resources are harvested as part of the KaAMS PBL lesson plans.

Students are presented with an environmental problem that is of concern of to a NASA mission. They begin a series of problem-solving lessons from which they develop content and applied knowledge by participating in problem solving activities. Through a series of framing and informing activities, students search for additional information on the problem, develop an understanding of the science of the problem, and propose a solutions for conducting a mission that will provide remote sensing data to solve the problem. Students become involved in "bursts" of activities to conduct a mission, collect and analyze data. Finally, students summarize their findings in several different ways and go public to share what they have learned with classmate and/or other outside their classroom. One important note is that the students participate in reflective activities throughout the entire process.

Developmentally Appropriate Lessons

Also evident in the design were the following key characteristics we found about middle school students (From: This We Believe).

- Moving from concrete to abstract thinking
- Curious on a wide range of topics, few of which are sustained
- Prefer active over passive learning
- Respond positively to participating in real life learning situations
- Are inquisitive and challenge adults
- Desire recognition

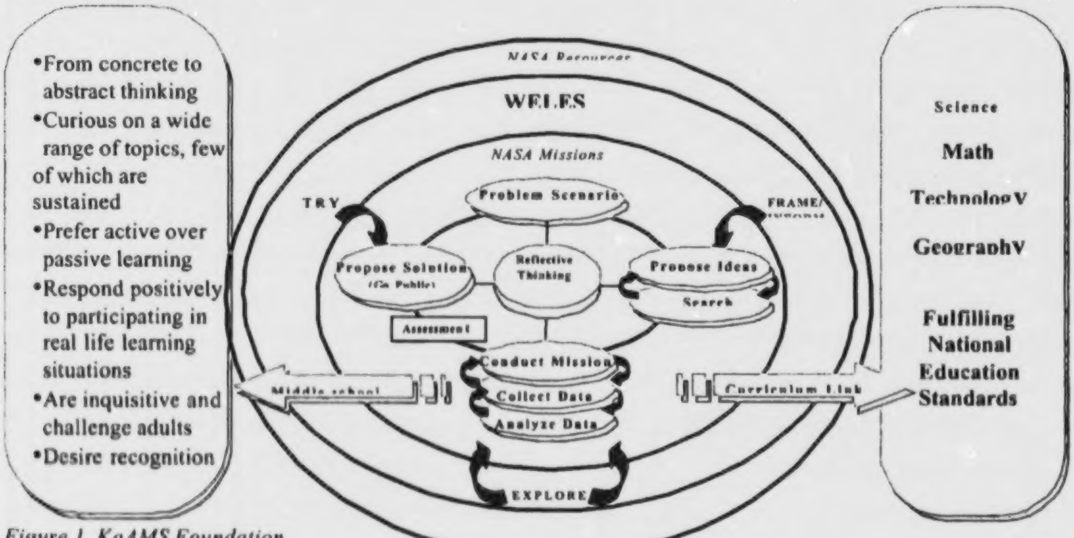
•From concrete to abstract thinking
•Curious on a wide range of topics, few of which are sustained
•Prefer active over passive learning
•Respond positively to participating in real life learning situations
•Are inquisitive and challenge adults
•Desire recognition
NASA Resources
WELES
NASA Missions
Problem Scenario
TRY
FRAME/
Propose Solution (Go Public)
Reflective Thinking
Propose Ideas
Search
Assessment
Conduct Mission
Collect Data
Analyze Data
Middle school
Curriculum Link
EXPLORE
Science
Math
Technology
Geography
Fulfilling National Education Standards

Figure 1. KaAMS Foundation

Links to National Standards

To maintain the link to the National Standards, we have completed an analysis of the NSTA/NRC standards and the AAAS Project 2061 Benchmarks to target in the KaAMS Project. Each lesson plan links to the specific national education standards that might be satisfied by completing the lesson activities

Flexibility

Since flexibility is very important to maximize the usability of this site, we have designed the site for the teacher. The framework is constructed so that the teacher is in control of how much and what types of the available activities that his or her students actually see. He or she can start from Phase 1 and proceed to Phase 4, or he or she can just go the activities of Phase 3, for example.

Mapping Design Attributes of KaAMs onto PBL and the Scientific Process

Problem-based learning and the scientific process follow similar steps. This cross over made explaining the learning process to content experts very easy. See Table 1. Some examples of how the design attributes were built into the KaAMs is shown in the last column.

Table 1. Mapping KaAMS onto the PBL Process

PBL Process	Scientific Process	KaAMS	Design Examples
Problem Clarification	Identify Problem	Problem Scenario	• Two problems—finding lava flows for the Pacific Disaster Center, and determining if the coral reef need protection for a real Congressional Executive Order
Plan Development	Research ideas and	Propose Ideas/Search for	• Activity Sheets as

	Develop plan for investigation	Information	Who, What, When, Where, Why and How questions to determine what the students know • Students complete reflection journals • Find information using existing NASA web resources • Participate in activity bursts to explore new concepts
Collect Information	Collect Data	Conduct Mission and Collect Data	• Students think critically about which aircraft can run their mission and select from several possibilities • Students plan the actual mission and compare it to the actual NASA mission
Analyze Information	Analyze Data	Analyze Data	• Students use actual data from the live missions to draw conclusions • Students use guidelines from NASA scientists for interpretation of their data
Present Solutions	Report Findings	Propose Solution: (Go Public)	• Write a report to the Pacific Disaster Center, • Make recommendations to the President in response to his executive order

Alpha Testing Phase

The assessment strategy for the entire KaAMS project was divided into three major phases designed to capture data that would support initial product development (alpha testing), on-going resources development and implementation planning (beta testing), and analysis of impact on the stakeholders in the learning environment (research-impact analysis). See Figure 2. The diagram below illustrates the flow of alpha, beta, and research processes used for each of the two major products being developed; (1) volcano mission and (2) coral reef mission. This report summarizes overall data collection methods and procedures as well as the findings from the alpha development cycle for Products 1 and 2 - Mission: Studying active lava flows.

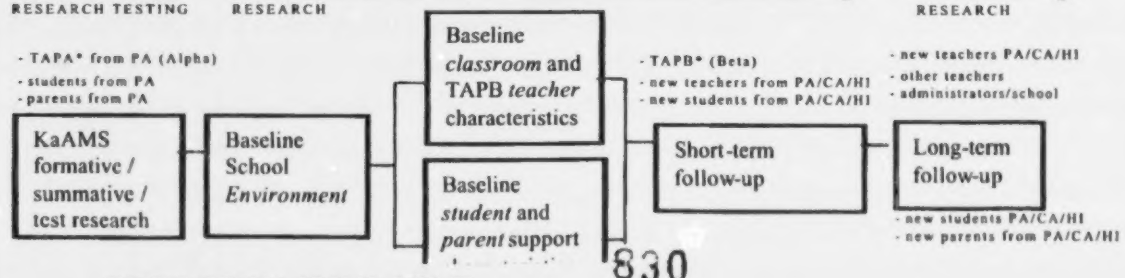
ALPHA TEST
RESEARCH TESTING
BETA TEST (new classrooms)
RESEARCH
IMPLEMENT (new classrooms)
RESEARCH
- TAPA* from PA (Alpha)
- students from PA
- parents from PA
KaAMS formative / summative / test research
Baseline School *Environment*
Baseline *classroom* and TAPB *teacher* characteristics
Baseline *student* and *parent* support
- TAPB* (Beta)
- new teachers from PA/CA/HI
- new students from PA/CA/HI
Short-term follow-up
- new teachers PA/CA/HI
- other teachers
- administrators/school
Long-term follow-up
- new students PA/CA/HI
- new parents from PA/CA/HI

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Figure 2. Overall Assessment and Research Strategy

Methods

During the Alpha testing formative and summative evaluation data were collected. With project enhancement in mind, data collected from key stakeholders during the alpha (initial formative development) testing phase included five levels of assessment: (1) reaction, (2) learning gains, (3) performance, (4) education system changes, and (5) impact on the greater society. Research protocols were also tested to assess their effectiveness in measuring the effects of KaAMS materials on teachers, students, and stakeholders in the surrounding community, namely parents. See Table 2.

Table 2: Research questions and assessment

Research Questions	Assessment
How are teachers using KaAMS and NASA resources?	Performance
How are teachers changing their teaching practices (e.g. teaching strategies, incorporation of NASA resources, etc.) over time as a result of using KaAMS and NASA resources?	Performance/ System Change
How are student levels of interest in pursuing science-related career changing over time as a result of using KaAMS and NASA resources?	Learning Gains
How does the use of KaAMS diffuse to the surrounding school system?	Impact on Greater Society

All formative evaluation instruments were administered throughout the alpha testing phases to gather feedback from teachers while preparing for and using the KaAMS materials. Interviews, observations, and focus groups were also conducted at least once per week with teachers and students during the 6-month alpha classroom trials. The summative instruments were administered to teachers at the end of the KaAMS classroom trials and final interviews and focus groups were conducted with teachers and students. The research instruments were administered to teachers and students for pre- and post-test data collection and at and additional 1-month follow-up period for students. Parents were surveyed at the beginning and end of the school year.

Subjects

Three middle schools in a rural Pennsylvania school district participated in the KaAMS alpha test classroom trials, East, West, and Distant. Six different classrooms from these schools were actively involved. Four were 6th grade, one was 7th grade, and one was an 8th grade honors class. The six teachers who participated provided data about themselves, their classrooms, and success of using KaAMS materials during the alpha testing cycle. Teaching experience ranged from 3 to 23 years; initial preferences for primary teaching strategies included hands-on activities, collaborative activities, role play, and problem-based learning; half of the teachers had moderate success using web resources in their classrooms the other half had not used such resources in their classrooms.

Data were collected from a total of 144 students, 82 were boys, 59 girls and 3 did not respond to the gender question. On average, the students had a moderate level of interest in pursuing science.

One hundred and fifty three parents of KaAMS students returned surveys indicating their initial perceptions of science in their school and child's success and interest in science as well as reporting their highest attained level of education. A majority of the parents did not have college degrees, worked in non-science related jobs, and had a neutral opinion of their child's school's science program.

Measures and Instruments

Formative and Summative evaluation: A series of instruments, observation protocols, and interview protocols were developed to collect formative and summative data from the teachers and students during the alpha testing development cycle.

Teachers were asked to review the KaAMS lesson plans, prepare to use the lesson plans in their classrooms, and complete evaluation surveys after each lesson and at the end of the trial indicating ease of use; value of resources, instructions, and assessment guidelines provided; success of activities; amount of preparation time; descriptions of the classroom activity during KaAMS lessons; and general feelings about using KaAMS for teaching and learning. Teachers were also asked to share feedback during interviews and focus groups including responses to questions such as: What did you like/not like about the supporting website? What parts of the lesson plans did you use - why? What additional support materials did you need to use these materials? What additional materials did the students need? What would you change?

Periodically students were asked, during interviews and focus groups, to respond to questions such as: What did you like/not like about the KaAMS activities? How useful were the internet sites? What was happening in the classroom during KaAMS? What did you learn? and what would have made these activities more useful to you? Observational data were collected several times during the classroom trial that lasted between 3 and 6 months, depending on the classroom teacher. Observation data were collected on how the teachers used the materials, how the students participated in the activities, and artifacts developed by the teacher or students during the KaAMS lessons.

Research: The research questions were focused on the teachers, students, and parents. Teachers completed an on-line instrument eliciting background information, preferences for classroom activities, and attitudes toward the use of web resources in the classroom. The instrument was a combination of an attitude survey previously developed and validated for similar research (Koszalka, 2000), a series of questions related to perceptions of their school's ability to support the use of internet technology in the classroom (McCarthy, Grabowski, & Koszalka, 1998), and preferences for teaching styles (Grabowski, Koszalka, & McCarthy, 2000; Koszalka, Grabowski, & McCarthy, 2000). This instrument was administered at the beginning of the classroom trial period and the end (pre-post test).

Data were collected on student level of career interest in science, pre-, post, and 1-month after using KaAMS materials. Student career interest surveys were purchased from the APA. The survey also included a series of questions developed to assess reflective thinking (Koszalka, et al., 2001) and gather demographic data.

Parents were asked to complete surveys at the beginning and end of the school year to assess their perceptions of their child's school's science program. The questions were taken from previous research on measuring parents' perceptions of school programs.

Results

The initial formative feedback provided guidance in designing support structures for the KaAMS website that helped the alpha teachers connect NASA science to their curriculum and prompt active student involvement, as scientists, during science class. The results from the formative and summative evaluation resulted in: development of enhanced lesson plan structures for the KaAMS website, new content support for teachers that strengthened the relationship between the overall problem scenario and learning activities, further instructions to 'coach' teachers in using PBL, web technology, and activities that prompt student reflection, stronger ties between lesson plans and national education standards and curriculum requirements, and enhanced activities that will better meet kids' needs. The initial research findings from the pilot classrooms were very encouraging. Although caution is warranted in interpreting these results, analysis of the research data collected during the alpha testing cycle showed significant, yet minor changes in teachers, students, and parents after the use of KaAMS in the classroom. Table 3 summarizes research findings in accordance with the KaAMS project research questions:

Table 3. Research questions and Alpha Preliminary Findings

Research Questions	Alpha Preliminary Findings
How are teachers using KaAMS and NASA resources?	Teachers noted the flexibility of KaAMS resources and used them in a variety of ways to enhance or change the way they teach.
How are teachers changing their teaching practices over time as a result of using KaAMS and NASA resources?	Several of the teachers tried new ways of integrating the web and collaborative activities into their teaching; changed their preferred method of teaching and the types of resources they used regularly in their classrooms, and their attitudes toward using web resources in the classroom.
How are student levels of interest in pursuing science-related career changing over time as a result of using KaAMS?	Significant increases in student level of science career interest
How does the use of the KaAMS products diffuse to the surrounding school system?	Parent perceptions of their child's school's emphasis on science, school's ability to provide good science experiences, and use of appropriate science resources were higher at the end of the school year than in the beginning.

We believe that we are providing teachers with a venue and structure for using NASA web-based materials in their classroom in meaningful and contextualized ways that will support student knowledge development in the content and processes of science. Through their high quality materials, NASA can make an impact on science in the classroom, which in combination with KaAMS strategies can change teaching practice, impress middle school kids with the importance of and strategies for conducting good science—the ultimate goal being to influence career aspirations of these kids toward science.

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Developing Online Courses: A Human-Centered Approach

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Abstract

Designing and building quality distance education is a challenge facing many organizations. Option Six is an independent company building customized e-learning solutions. Over the last two years, the instructional designers and user experience analysts at Option Six worked to help develop a four-stage process for evaluating e-learning courses. The process is built around Donald Norman's (2000) definition of human-centered design. This paper describes the process used by Option Six and outlines the benefits and challenge of human-centered design for distance education.

Introduction

Companies and universities are increasingly moving to online delivery for much of their training and education needs. Start-ups, consulting companies, and even universities are touting their ability to deliver quality e-learning to employees worldwide. With so many entities vying for students on a global scale, the issue of quality is becoming an increasing concern. Evaluating distance education is problematic in a number of ways. First, traditional student evaluations at the end of a face-to-face course typically focus on the experience students have with a particular instructor. With most online education, these methods are not valid as a single measure because the instructor's role is only one part of a much broader experience. Technology, the user interface, and the design of content are all keys in understanding the distance learner's experience.

Second, in a face-to-face course, the instructor has the benefit of being able to see the students' reactions to a number of varied teaching exercises. Nodding heads, yawns, and verbal interaction all serve as tacit "formative" evaluation of a course in progress. Distance courses do not have such luxury and not having that interaction can cause severe problems for the students and the instructor (Wang-Chavez & Branon 2000).

Finally, the rapid pace of change in e-learning makes knowing exactly which design principles are "correct" difficult to determine (Williams, Paprock, & Covington, 1999). Donald Norman President of UNext Learning Systems and author of such books as "The Design of Every Day Things" and "The Invisible Computer", has noted that computers are complex and hard to use because we are asking them to do complex tasks (Norman, 2000). Few tasks are as complex as education and finding the "best way" to design online education is likely to be an elusive goal for quite some time. Human-centered development, however, utilizes input from students in the target audience during the earliest stages of development. By having students involved early, unnecessary complexity can be eliminated and learning can be maximized.

Option Six

Located in Bloomington, IN, Option Six opened in January 2000 as the Bloomington Development Center (BDC) for UNext, Incorporated. In September 2001 the BDC spun off to form a new company, building and designing online courses for a number organizations. The team at Option Six has built courses with faculty from Stanford, Columbia, Carnegie-Mellon, The London School of Economics, the University of Chicago, and Indiana University. Students at a variety of organizations including General Motors, Merrill Lynch, UCLA, and MIT have taken courses built by Option Six team members.

In order to create high-quality courses, Option Six utilizes a team-based approach driven by human-centered design principles. Each team is comprised of members from a variety of disciplines. The point-person for the team is an instructional designer. Instructional designers work with subject-matter experts (SME) to determine the pedagogical strategy for the course. Editors set the tone for the course and ensure consistency in language usage. Visual designers create the look and feel for a course, including graphics, and work closely with multimedia developers to build interactive components (Flash, video, etc.). User Experience (UE) analysts work with the team to gather data from students in the target audience, which is the core of the human-centered design process.

Human-Centered Design Process

Donald Norman, former President of UNext Learning Systems, defines human-centered design in his book, *The Invisible Computer:*

> "It's a process of product development that starts with users and their needs rather than with the technology. The goal is a technology that serves the user, where the technology fits the task and the complexity is that of the task, not the tool." (p.185).

Option Six uses an online course development process that is driven by this definition. The process has four primary components that focus development around the student, rather than the technology. Guiding the development of the process is a desire to produce the highest quality online courses with cost-effective user-testing methods. Each phase is designed to maximize resources while minimizing the impact on the overall development timeline.

Each stage in the process has a specific objective. Early stages are designed to catch major design flaws and to identify conceptual difficulties with the material. Large structural flaws in the interface or content tend to be the most expensive and time-consuming problems to correct late in the process. The difficulty is that the early stages of development are the most conceptual and can be somewhat difficult to test with large numbers of users.

The result is a process that starts with expert evaluators (User Experience analysts) conducting design consulting. In the second phase, participatory design, two or three students test components of the course to identify learning issues. The third phase is an accelerated integration test in a laboratory. Finally, an instructional pilot is run with students working in naturalistic setting (work, home, etc.) at a pace that would be expected for the course. At any point during this process it is the data from the students that determines whether the course is ready for the next phase of development. Multiple revisions to materials are anticipated and even expected.

Design Consulting

Design consulting is not a stage in the process but is an ongoing element throughout development. In team meetings, this often means an analyst provides past student testing data to inform decisions. Most importantly, the analyst acts as an objective set of 'fresh eyes' looking at a course in early stages of development. The goal of the analyst in this phase is not to replace student testing but to act as a 'user advocate' within the design team. Once student testing begins, the design-consulting role includes making recommendations based on user feedback and interim evaluation of product improvements. Several distinct techniques are used to maximize the skills of the analyst in conjunction with student data.

Cognitive Walkthrough

Structured inspection methods are one important way for UE analysts to determine the viability of course organization. Cognitive walkthroughs are a common technique for usability experts and involve following a predetermined path through material to look for potential points of failure (Wharton, Rieman, Clayton, & Polson, 1994). The effectiveness of cognitive walkthroughs is dependent on the expertise of the evaluator and will not necessarily catch all problems (John & Mashyna, 1997). As a part of a larger user-testing strategy, however, they are quite effective for providing an objective eye to inform the design team of major flaws in interface design.

Heuristic Evaluation

Though Option Six does not employ heuristic evaluations for all courses, this method has value when looking at new interfaces or small course components. Heuristic evaluations involve setting metrics for an analyst to use when assessing a course. The technique is less structured than a cognitive walkthrough and allows exploration of the course environment (Sears, 1997). Analysts are looking for aspects of the course that do not meet certain broad standards (readability, ease of understanding, technical problems, etc.) Again, such a technique by itself does not ensure a high-quality course but, as a first-stage pass through the material, it catches many major flaws.

Participatory Design

Participatory design is the fist phase of a three-phase testing process. Components of the course are tested with two or three students from the intended target audience. The emphasis in this phase of testing is on high-level conceptual understanding of the course materials. Students work through a combination of early screen designs and paper prototypes of course materials and give continuous feedback to the analyst about whether concepts and procedures are clear and the interface design is usable. As the title implies, the user becomes a co-designer in the design process by providing suggestions for improvement rather than simply identifying problems.

The timeline for a project is built around the idea that development will require multiple iterations based on this early student feedback. Complex content or media often undergo multiple changes in order to ensure students are able to effectively navigate and learn. Many of the worst problems with the material are identified and corrected at this point in the process, saving time and money as the project moves toward completion.

Integration Testing

When development is nearly complete, all of the components are assembled in electronic form and presented as a complete course. Six paid students, who have the same background as the intended target audience, work in a lab environment to take the course. In this phase, there is less emphasis on having the student interact with the design team. The timeframe is compressed (students work six hours per day online) and data is gathered through observation and interviews, rather than participatory design sessions.

In university credit courses, an onsite instructor is also added during this phase to grade assignments and provide feedback to the team about whether students are meeting the learning objectives. The analyst works with observation, interview, and instructor data to develop a profile of overall course effectiveness. Problems with individual parts of the course are noted and the development team makes revisions based on the feedback. Severe problems (e.g., overall course structure is ineffective) are rare at this stage but if any are found, the entire course is retested after revisions.

Instructional Pilot Testing

After the development team is confident all major issues have been resolved, the completed course is uploaded to external web servers and readied for a 'real world' test. Eight students who match the target audience are recruited and paid to work on the course over a realistic timeframe in their own environment. The amount of time varies with the length of time students would be expected to spend on a course. A 30-hour course (roughly one university credit hour) that should take about six weeks to complete would be tested over a three-week period. This timeframe is still slightly compressed to meet development timelines but is much more realistic than in earlier phases of testing.

A User Experience analyst gathers data from telephone interviews, online survey forms, instructor feedback and analysis of online student interaction. The focus is on understanding what potential issues exist for instructors and students as the course is released to paying students. If any development issues are discovered they are also corrected during this phase. Once this phase of testing is complete, the course is ready for release.

Lessons Learned

Using the process outlined above on nearly 30 courses has yielded some interesting lessons on taking a human-centered approach to online course design. Perhaps the single most important lesson was that the process itself involved iterative design. The initial implementation of the human-centered process was too slow and too expensive to be fiscally viable. The process outlined in this paper is the result of much trial and error and additional changes will certainly be made in the future.

Benefits

One lesson learned was that using a human-centered process is key in building high-quality online courses. Subsequent commercial trials and release of a number of courses showed that customers were very pleased with the quality of the courses. Most major technical problems and flaws were discovered prior to release, thus saving money by limiting the need for technical support.

An early model of the process focused on student testing near the end of the development cycle. At that point, however, a great deal of time and effort had been put into programming, graphic design, and course structure.

Major problems were often discovered near the end of the timeline, which jeopardized due dates and cost more money to fix. By making students part of the design team (participatory design phase), most major problems are caught and corrected before too much effort is expended. Interestingly, there are generally only two or three students in this phase, which indicates that it only takes a few users to uncover major problems.

Instructional designers and some members of the development team were initially skeptical of whether user testing could improve the product. One of the unintended benefits was that by seeing their designs being used by students, developers were able to improve their own understanding of how design could be shaped to improve online learning.

Challenges

Creating a human-centered design process involves many challenges. The goal is to ensure a quality user experience with all aspects of an online course. Initially, the User Experience group in the Bloomington office was staffed with usability and information science professionals. It became apparent that guaranteeing a quality experience for online learning would require more than 'traditional' interface design testing. Adding UE team members with instructional design experience and visual design knowledge broadened the group's understanding of how students were interacting and whether they were learning. The first lesson learned was that having a multidisciplinary User Experience group is essential for evaluating online learning (Norman, 2000).

As many organizations are discovering, creating quality e-learning can be an expensive proposition. Finding students in the target audience for business courses (mostly business professionals) required that they be well paid for their time. For lengthy courses, the cost for testing, including facilities, UE salaries, and pay for students can run as high as $35,000. This cost is minimal for an organization looking to roll out a course to thousands of employees but most universities will not find an acceptable return on investment for this level of testing. In fact, the elimination of potential problems is an investment that can pay big dividends when the economies of scale a large enough.

Another issue with this model is that students are paid for their time. Paid students will obviously have a very different motivation for completing a course than a paying student. This is a difficult problem to overcome when looking for people with specific skills and backgrounds. One potential solution to this problem is to offer businesses 'free' training if employees are willing to provide feedback to the design team. This approach is helpful but can only be used in the latter testing phases when the course is nearly complete.

Conclusion

While the process described in this paper is extremely expensive, there are low cost alternatives to each phase that can improve the quality of online courses. For example, in a university setting, design consulting can be accomplished by having a colleague look at paper prototypes of materials. Even if they do not have time to work through an entire course, students who have taken a face-to-face version of a course make great participatory design subjects. Simply asking a student walkthrough how they would get through an assignment will reveal many flaws in the initial design.

Integration testing is the most problematic phase of the process to conduct on a budget. It is unlikely that most universities can afford to hire students to take a semester-long course before it is taught. One alternative, however, is to continue evaluating the course while it is being taught. This is done implicitly in face-to-face courses and must be explicit in distance courses. Sending a mid-semester survey to ask students how a class is going can provide data to make corrections and improve students' perception of the course (Wang-Chavez & Branon 2000).

Additionally, as a designer builds more courses within a particular domain, the need for testing should decrease. Option Six originally had a much more extensive testing process but as the development teams gained experience, less testing was needed to achieve the same result. Regardless of the level of project, getting input from students is an essential component in quality online course development.

Building a human-centered process for online course development has provided a number of opportunities and challenges. After observing students taking a number of web-based courses the most important conclusion is that no designer can anticipate every issue. By putting students at the center of the design process, a team can proceed with confidence and prevent costly issues with the final product.

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USABILITY TESTING OF THE INDIANA UNIVERSITY EDUCATION FACULTY WEB FORMS

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Abstract

The usability test team attempted to identify design problems that limit the ability of instructors at the Indiana University to use data entry forms on the School of Education Web site. The forms permit instructors to publish information about themselves and about courses they teach on the School of Education web site. We asked faculty and graduate student instructors to perform typical tasks with the web forms under observation. We requested that the participants describe what they were thinking and feeling as they attempted to perform the task. From these observations, we identified several key design problems that prevented or frustrated the participants. We also recommended solutions to eliminate these problems.

Introduction

Over the past couple of years the use of the World-Wide Web (WWW) has increased dramatically. People use the WWW to gather information that informs their day-to-day decision making processes. Organizations of every kind are also making information readily available on the Web. The School of Education at Indiana University has recently decided to make information about course instructors, and information about classes taught in the School of Education available on their public web server (http://education.indiana.edu). Instructors can add information to their listing under the faculty/staff directory. Instructors can also add information about classes they teach to the School of Education course catalog. The ability of users to effectively perform tasks with web sites and data entry interfaces is a major factor in the total cost of a computer information system. Poor design can add to the cost of an information system by reducing efficiency, and adding to instructional and performance support costs (Landauer, 1995). Design problems that hinder the ability of instructors to use these forms may also hinder the adoption of these forms by the School of Education community, and also add to the hidden costs of adding these forms.

People use computers in order to achieve goals within a situated context (Suchman, 1987). Usability testing involves observing people attempting to achieve specific goals within a specific context. Frick & Boling (1999) claim that three factors are considered important in the design of a usability test for a web site:

1. The participants must match the intended audience of the web site.
2. The participants must be given authentic tasks that they may be required to perform as part of their use of the web site.
3. The context in which the test is performed should match the actual work context in which the users would perform authentic tasks.

Methodology

In this research, we focused our data gathering efforts on the target population of faculty and staff of the School of Education. This group also includes graduate students working as Assistant Instructors in the school. The following sections will explain the sample population, the research questions, the process of collecting data, and the process of debriefing and data analysis.

Population Sample

We used a convenience sample in order to try and get a number of participants from our target population with medium to low HTML and web skills. We felt that with a small population sample of 8-10 participants, and participants with less web experience would accentuate problems in the web forms interface we were testing. In addition to seeking participants with low web skills, we also sought to get participants from many different departments. We also tried, without success, to get an even gender representation in our population sample. Table 1 shows information about the nine participants in our usability tests.

Table 1. Participants in the Usability Test

Participant	Position	Skill Level	Department	Gender
Participant 1	Research Faculty	Low	Dean's Office	Female
Participant 2	Faculty	Low	Early Childhood	Male
Participant 3	AI	Medium-low	Language Education	Male
Participant 4	Faculty	Low	Instructional Systems Technology	Male
Participant 5	Faculty	Low	Educational Leadership and Policy Studies	Male
Participant 6	AI	Medium-low	Math Education	Male
Participant 7	Faculty	Low	Special Education	Male
Participant 8	Faculty	Low	Educational Leadership and Policy Studies	Male
Participant 9	Faculty	Low	Secondary Education	Male

Research Questions

There are two main questions that we investigated as part of this project:

1. What are the design problems that prevent or discourage faculty and staff from using the web forms to add/update their online profile information?
2. What are the design problems that prevent or discourage faculty and staff from using the web forms to add/update a syllabus link to a course in the School of Education course catalog?

These are both important questions to address because if the faculty and staff cannot easily update this information, then there is a high likelihood that they will not take the time to add/update their personal information and course information. This could potentially result in frustration by users seeking information using the school's web pages.

Data Collection

We observed the participants performing the following two tasks:

1. Add/update their personal profiles to the School of Education faculty and staff directories on the Web.
2. Add a syllabus link to a course in the School of Education course catalog on the Web.

We tried to make the tasks as ***authentic*** as possible by

- Having the participants perform the tasks in the environments where they would normally perform the tasks (e.g., their offices or public computing labs).
- We contacted the participants ahead of time and asked them to have a copy of their syllabus (or know the link if already online) ready to use in the testing. This allowed the ones who came prepared with their own syllabi, to post their syllabi to the web for an actual course. (We also had a copy of a syllabus on disk in MS Word format that a couple of individuals who had forgotten used. In these cases, they posted to a test course R999 that was set up by the Web director.)

We also swapped the order that different participants were asked to do the two tasks in order to try and eliminate overlooking problems that might occur by doing the tasks in different orders.

We asked the participants to "think aloud" while they were performing the tasks. Meanwhile, the observers took notes of difficulties and problems they were having. We also timed each of the tasks.

Data Analysis

After all of the usability testing observation sessions had been completed, the four members of our project team met to debrief and analyze our findings. We grouped similar problems together and recorded a short description of the problem along with the number of participants that reported the problem. We then ranked the problems according to the following criteria:

1. **Most critical:** Problem prevented the subject from accomplishing the desired task or the subject reported high levels of frustration in regards to this problem.
2. **Critical:** Problem resulted in confusion or misdirection that did not prevent the subject from accomplishing the desired task.
3. **Not-critical:** Problem was reported as confusing or undesirable but there is no urgent need to fix this problem to insure functionality.
4. **Low-priority:** Problem should be examined on a case-by-case basis.

We then linked the problems to specific stages in the process at which the problem occurred. We also provided recommendations for fixing the problem, as well as recommendations for re-designing the site as a whole.

Findings and Recommendations

Task 1: Add/Update Profile

In our usability test we asked the participants to add or update their personal profile. The personal profile is published with the staff and faculty directory, and is linked to entries in the course catalog. Figure 1 shows the task of adding/updating a profile broken down into six sequential steps. The web forms interface consists of three separate pages. The first page (Demographics) asks for the instructor's name and email address. The second page (Contact Info) asks for office location and telephone number. The third page (Personal Info) asks for a large amount of information including job title, department, home page and optional fields for more information and links to other web sites.

Most participants experienced problems on the Personal Info page. Participants reported frustration with the large size of the page and the variety of information requested. Some participants also reported problems interpreting instructions and anticipating how the information they entered would be displayed.

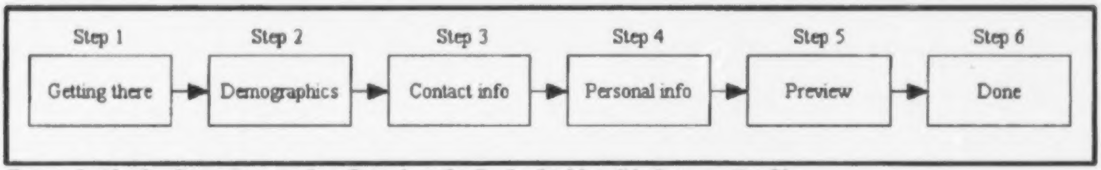

Figure 2. The Six Steps Required to Complete the Task of Adding/Updating a Profile

Step 1: Getting to the Profiles Page

This section of the report deals with challenges that the users had in finding the web forms that they could use to add or update their personal profiles. Table 2 outlines our findings and recommendations for improvement of this step in the process.

Table 2. Findings and Recommendations for Getting to Profile Web Forms

Findings (Observations)	Rating	Recommendation
Three participants experienced some difficulties in finding the first profile web form page. These individuals followed the path that took them to the Faculty and Staff Directory. They would go to their existing profile and from that page (the old profile formats) there was not a link to update their individual profile. Although there was a link to update profiles from the Faculty and Staff Directory page it was not easy for these participants to locate.	1	The impact of this problem may be reduced by making the link on the Faculty and Staff Directory more obvious. Currently the only word that is linked is the word "here" that is embedded in the middle of a couple of lines of text. The link text could be changed to something like "Add/Update Your Profile" and placed on its own line.
Three participants expressed uncertainty about	3	Try re-writing documentation to eliminate ambiguity.

which password they should use in order to update their profiles. Only one participant actually typed in the wrong password and had to go back and re-enter another password.		Unfortunately this problem needs to be addressed by University Information Technology Services and not the designers of the web forms.

Step 2: Adding/Updating Demographic Information

This section of the report deals with challenges that the users had in adding or changing their name and email address. Table 3 outlines our findings and recommendations for improvement of this step in the process.

Table 3. Findings and Recommendations for Adding Demographic Information

Findings (Observations)	Rating	Recommendation
Two participants discovered that the middle name did not appear in the final profile. One of the individuals uses his middle name as his preferred name, and ended up getting around the system by placing his middle name in the first name slot.	2	Don't ask for a name that will not be included on the profile page. Both of the following solutions might be acceptable: • Include all three names in the profile page. • Have a preferred name slot and a last name slot. • Have one text blank labeled "Full Name to appear in profile"
Two of the participants were confused by the wording on the submit button on this page which read, "Save the data in this form and add your office location information." They didn't realize that the "and add your office location information" part of the text was referring to what they would do on the next page.	2	Our recommendation for this option is to add a ***wizard style navigation*** header and footer to each of the profile pages. (This recommendation will also address several other findings from the usability test.) For details on this recommendation, see the General Recommendations for Add/Update Profiles Pages section of this report. If the wizard style navigation recommendation is not taken, the wording of the button could be changed to something like, "Save the demographic info and go onto the next step."

Step 3: Adding/Updating Contact Information

This section of the report deals with challenges that the users had in adding office location and contact information to their personal profile. Table 4 outlines our findings and recommendations for improvement of this step in the process.

Table 4. Findings and Recommendations for Adding Contact Information

Findings (Observations)	Rating	Recommendation
One individual didn't realize that when he updated his room number he also had to click on the corresponding radio button. (Incidentally, if the radio button is selected without entering a room number in the text box, you are taken to a blank screen which says, "Your form was Processed" and nothing else.)	1	The form could be simplified by having a box in which the room number could be placed and instructions to leave the box empty if they don't have a room. The current radio buttons could be kept and JavaScript could be used to select the appropriate radio button when a number is entered in the text box.

Step 4: Adding/Updating Personal Information

This section of the report deals with challenges that the users had adding personal information about themselves and what they do in the School of Education. Table 5 outlines our findings and recommendations for improvement of this step in the process.

Table 5. Findings and Recommendations for Adding Personal Information

Findings (Observations)	Rating	Recommendation
Five of the participants reported skipping the optional "More about me" fields because of perceived complexity of the instructions for entering HTML. They were not able to add information to their profiles that they wanted to because they felt that it would be too complex for them to do it.	1	Simplify the task by using formatted plain text only. OR Give radio button choice for each text box indicating "Plain Text (default)" or "HTML" like in AltaVista Forum (AVF)
Participants didn't seem to understand if text boxes would be WYSIWYG or HTML. In one case a participant entered multiple titles separated by a carriage return and was surprised to see them squashed together on the final profile. (There are inconsistencies - for example the "What You Do" section converts completely to HTML with no hard carriage returns while the "More About Me" section allows links to be added but also recognizes carriage returns.)	1	Simplify the task by using formatted plain text only. OR Give radio button choice for each text box indicating "Plain Text (default)" or "HTML" like in AVF OR Use the server-side CGI script to check text block for any HTML tags. If there are tags format as HTML otherwise format as plain text.
Three participants were a little confused by the text box labeled "Name of your office/unit. At least one filled in the name of his office even though he had checked the box for the office above. The indentation of the fields relative to the other options seemed confusing to the participants. People tended not to read the * instructions carefully.	2	Align all choices equally. Have a checkbox directly below the others followed by a blank text box for them to enter their office/unit if it is different. A * could be placed at the end of the text box and another * could be placed below with instructions about how to enter the URL for the "other" unit.
Two participants expressed uncertainty about what to put into the section labeled "What Yo u Do." The concern was whether this was just for faculty/staff job responsibilities or if it could contain other kinds of information too.	2	This problem could easily be solved by providing more explicit guidelines about what should go in this area. Also, being able to see an example of a typical profile might allow them to see where it would be most appropriate to stick different pieces of information about themselves.
It was our observation that participants were overwhelmed with the amount of information being requested on this page.	2	This problem could be solved by using the ***wizard style navigation*** (see description in section General Recommendations for Add/Update Profile Page). Using this system this step could easily be divided into several more simple steps.

Step 5: Previewing and Publishing a Profile

This section of the report deals with challenges that the users had in previewing and publishing their profile. Table 6 outlines our findings and recommendations for improvement of this step in the process.

Table 6. Findings and Recommendations for Previewing and Publishing a Profile

Findings (Observations)	Rating	Recommendation
Three of the participants considered clicking the "Update this profile" link that is embedded into the profile preview instead of the publish preview button. This generally happened because they were scrolled down to the middle of the page where they could not see the buttons and the link text sounded like it would do what they wanted to do.	1	To solve this problem we suggest that changing the wording of the link text from "Update this profile" to something like "Start the update profile wizard" or "Go to the Update Profile Pages." We feel that a different wording like this will be harder to confuse with publishing or actually saving the updates.
Three participants in the usability test did not	1	Doing something to make the reload reminder obvious,

remember to click the reload button after going back to make changes to their profiles, even though the first line of instructions reminded them too. In general, they read the instruction block the first time they arrived at the page but did not re-read it on subsequent visits.		even without reading the instruction block over, could solve this problem. A couple of possibilities might be changing the color of the word "reload" and making it bold. Or the word reload could be made to blink on and off. OR A server-side solution might be to write the temporary profile to a file with a different name each time - perhaps <timestamp>.html. When the user publishes the profile the temporary file is written and deleted. OR The tradeoff might make using a meta-tag that automatically forces the page to be reloaded every time worth it.
Several participants commented that it would have been helpful to be able to see examples of profiles or even preview their own profiles during the process instead of having to wait until the very end and then go back to make changes at the appropriate step.	2	This problem could be taken care of by implementing the solution that is mentioned under ***wizard style navigation*** section later in the report. Under this system, the users could preview their profile at any step through the process.
One individual didn't readily see the information entered in the "More About Me" fields on the profile preview. He finally found them below the map and said that he felt like they should have belonged above the map.	3	Move the link to the "More about me" entries from the middle of the demographic information to a more prominent location.

Step 6: Post-publishing steps

This section of the report deals with challenges that the users had with navigational steps required after the profile is published on the web. Table 7 outlines our findings and recommendations for improvement of this step in the process.

Table 7. Findings and Recommendations for Post-Publishing Steps

Findings (Observations)	Rating	Recommendation
One person exited the web browser directly after publishing the profile because he was following the red highlighted text at the bottom of the page literally. Then he started his web browser right back up.	4	The wording of the message could be changed to not imply that the browser should be closed right then, but that it should be closed before they leave the machine.
One person indicated that he felt like there were too many link options on the last page. He felt that it was confusing.	4	We are not sure that this is a problem that needs fixing.

General Recommendations for Add/Update Profile Pages

We have one general recommendation for the profile submission forms. This is a general recommendation because it addresses several of the findings observed in the usability testing and mentioned earlier in the document. Our general recommendation is to change the navigation system to a "wizard style navigation". What we mean by this is explained in the following section.

Wizard Style Navigation

A "wizard" is a tool that helps to step a person through a linear process by displaying the current position in the process as well as providing controls to move forward or backwards in the process. We think that including a wizard navigation header and footer on each page would be an ideal way to address many of the issues mentioned earlier in the findings. The wizard navigation would graphically outline the steps and indicate where the person is in the overall process. It should contain buttons to allow the user to progress forward through the steps as well as backwards through the steps. Ideally, the navigation bar would also have a preview button and a publish button which would allow the user to preview or publish the current state of the profile at any time in the process.

Task 2: Add/Update Syllabus Link to Course Catalog

This task tests web forms that allow instructors to publish information about a course they teach on the School of Education course catalog. The web forms give instructors four options for entering a course description or syllabus:

1. Enter a syllabus as HTML-formatted text.
2. Enter a syllabus as plain text with carriage returns.
3. Enter a link to an existing syllabus on the WWW.
4. Enter a link to Oncourse, a web-based academic conferencing system.

Seven participants tried the HTML path. One participant tried the Plain Text path and two tried the syllabus link path. No individuals tried the Oncourse path. One participant tried multiple paths in order to achieve good results.

The most critical problem we found was that out of seven participants who attempted to enter HTML-formatted text, six found that following the instructions did not produce the desired results. The instructions on the web form direct the participants to convert their syllabus from a word processor document to HTML text using Microsoft Word 97, then paste the resulting HTML-coded text into a web form text box. In most cases Word 97 failed to produce readable HTML-formatted text.

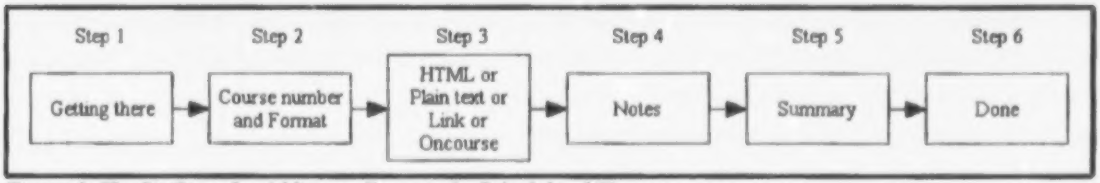

Figure 3. The Six Steps for Adding an Entry to the Schedule of Classes

Step 1: Getting To the Add or Update a Syllabus Page

This section of the report deals with challenges the users had finding the web forms that permit them to add a course entry to School of Education web site. Table 8 outlines our findings and recommendations for improvement of this step in the process.

Table 8. Findings and Recommendations for Getting to the Add a Course Web Form

Findings (Observations)	Rating	Recommendation
The link text (on page updates.html) indicates that you can **add** a syllabus link but not update a syllabus link.	2	Change the link text to say "Add/Update . . ."
The link text to enter the forms from the course catalog is somewhat confusing. It states "Add/Modify your course web site."	2	The text should be changed to read something link "Add/Modify syllabus link for this course" or something similar. In addition the text at the top of the course catalog table should be made clearer by changing it to "Syllabus Link(s)" instead of just "Link(s)"

Step 2: Entering a Course Number and Choosing a Format

This section of the report deals with challenges the users had entering a course number and choosing a syllabus format. Table 9 outlines our findings and recommendations for improvement of this step in the process.

Table 9. Findings and Recommendations for Entering a Course Number and Choosing a Format

Findings (Observations)	Rating	Recommendation
Four participants typed a lower case letter first for the course number.	2	Use server-side CGI to set the case of the letter rather than forcing user to do it.
When the participants got the error message for typing in a lower case letter or not selecting a radio button the error message is incorrect and says "Click the back button and enter the **filename** in CAPITAL letters."	2	Check all error messages and make sure that they are appropriate for the error. The two errors mentioned should have different error messages and the message for the first error should read "Course Number" instead of "filename."

Step 3.a: Adding an HTML-Formatted Syllabus

This section of the report deals with challenges the users had adding an HTML-formatted syllabus to the School of Education web site. Table 10 outlines our findings and recommendations for improvement of this step in the process.

Table 10. Findings and Recommendations for Adding an HTML Formatted Syllabus

Findings (Observations)	Rating	Recommendation
Six participants followed the instructions to convert a word-processed document to HTML and didn't get results that they were satisfied with. (Tables and tab-formatted documents notably had problems and participants didn't have skills to make changes.)	1	See general recommendations below.
Five of the participants complained about being forced to use MSWord. Their word processor of choice was WordPerfect.	1	Same as above.
The forms don't allow the user to edit a syllabus that has been added. To make one change to the syllabus they must edit their Word document and go through the whole conversion process again. (This can be painful for just a spelling change or something.)	1	Allowing to upload syllabi in their original format would solve this problem. OR Load the syllabus HTML text into the text box when a syllabus already exists.
Five individuals commented on the reference to the "Title Box **below**" when the title box was really above	2	Change the text to read "above" instead of "below."
Following the HTML instructions was difficult because the users had to switch back and forth between the word processing window and the browser window. Each time the users had to re-find where they were in the process. (One individual skipped the step of changing the word processor to "view html source" and therefore ended up in the end with a bunch of words all scrunched together - spaces removed.)	2	Suggest in the instructions that the user print out the instructions to reduce the chances of skipping steps.

Step 3.b: Adding a Plain Text Formatted Syllabus

This section of the report deals with challenges the users adding a plain text syllabus to the School of Education web site. Table 11 outlines our findings and recommendations for improvement of this step in the process.

Table 11. Findings and Recommendations for Adding a Plain Text Formatted Syllabus

Findings (Observations)	Rating	Recommendation
One participant pasted plain text copied from a	2	Strengthen wording in instructions to indicate that most

word-processing document into textbox but was unsatisfied with results.		text formatting will be lost.

Steps 3.c: Adding a Link to an Existing Syllabus Elsewhere on the WWW

This section of the report deals with challenges the users had adding a hypertext link from the School of Education course catalog to an existing syllabus elsewhere on the WWW. Table 12 outlines our findings and recommendations for improvement of this step in the process.

Table 12. Findings and Recommendations for Adding a Link to an Existing Syllabus Elsewhere on the WWW

Findings (Observations)	Rating	Recommendation
Participant was unable to find syllabus published on School of Education web server prior to installation of new web forms.	3	Provide suggestions for finding URL of published syllabus. Also consider providing links to Indiana University web search tool.

Steps 3.d: Adding a Link to Oncourse

This section of the report deals with challenges the users had adding a hypertext link from the School of Education course catalog to Oncourse, an online academic information system developed by Indiana University Information Technology Services. No participants selected this option.

Step 4: Adding Additional Notes to the Course Entry

This section of the report deals with challenges the users had adding additional notes to the course entry. Table 13 outlines our findings and recommendations for improvement of this step in the process.

Table 13. Findings and Recommendations for Adding Additional Notes to a Course Entry

Findings (Observations)	Rating	Recommendation
Four of the users did not even enter anything in the notes block because they were just not sure what kind of information should go there. One individual put several paragraphs about himself in the notes area.	2	The instructions should be changed to indicate what kind of information should be included in the notes. AND An example or preview might help.

Step 5: Viewing Summary Information

This section of the report deals with challenges the users had interpreting summary information provided about a course entry. No problems were observed with this step.

Step 6: Post-Publishing Steps

This section of the report deals with challenges the users had viewing updated course entries after they were published. Table 14 outlines our findings and recommendations for improvement of this step in the process.

Table 14. Findings and Recommendations for Post Publishing Steps

Findings (Observations)	Rating	Recommendation
Participant went back through web forms to make changes. Participant then tried to view changes but failed to reload web page.	2	Add tag to web pages to force the course schedule and syllabus to reload if possible.

General Recommendations for Adding or Updating a Course Entry to the School of Education Course Catalog

Converting a word-processing document to HTML text caused serious problems for all but one of the individuals that attempted the process. This procedure resulted in four different types of problems affecting a large percentage of our participants. We do not feel we have enough information to properly recommend a solution to this problem. Possible solutions may include providing the ability to upload word processing documents, conversion of word processing documents to Adobe PDF, or providing technical assistance.

Participants also reported problems with the instructions provided on the web forms and with labels of text fields. We recommend that the instructions and descriptive text be edited to correct errors and reduce ambiguity.

Limitations

Three of the main limitations to our findings involve the selection of our participants:

1. Only one of our participants was female.
2. Only two of our participants were Associate Instructors.
3. We did not recruit participants that had high levels of computer experience.

We attempted to recruit more women and associate instructors. However we were unable to arrange test sessions with most of the women and associate instructors we contacted. It is possible that having greater representation in both of these groups may have added insights to the information we gathered. We also did not recruit participants with high levels of computer experience. We deliberately selected a convenience sample of individuals with low to moderate computer experience in order to maximize observation of design problems experienced by novice users. As a result, we don't make any generalizations regarding the ability of instructors in the School of Education to use these forms.

Additionally, none of the people that we did the usability testing with had done either of the tasks before. Therefore, our tests did a good job of testing what a novice to the system would do in adding information to the system, but didn't explore what challenges would be faced by someone who had already entered data and just wanted to make a small change (e.g., a new phone number, link, or spelling correction/date change to syllabus). We have a hunch that there may be additional problems that surface when this aspect of the system is tested.

Some other problems came out during testing. None of the participants tried to add an Oncourse syllabus to the course catalog. Although the process is very similar to adding a syllabus link, some testing of this should be done to ensure usability. Several participants also reported that they would have abandoned some steps in the process if they had not been participating in a usability study. Participants reported that being observed encouraged them to tackle problems that would have led them to give up.

Conclusion

We found multiple problems with the design of the web forms that hindered or prevented our participants from successfully completing these tasks. Re-designing the web forms in order to reduce or eliminate these problems is in our opinion essential to ensuring the adoption of these web forms within the School of Education. The designers of this web site should address the following problems in future versions of the web site:

1. The recommended procedure for adding an HTML-formatted syllabus to the School of Education web site fails to produce satisfactory results. The designers should find tools that produce reliable results, or eliminate this option. The School of Education may need to make organizational changes such as employing specialists to assist instructors in preparing electronic versions if this feature is desired.
2. The Personal Information page causes problems for uses due to its length and complexity. At a minimum the form should be separated into two pages, one for required information and one for optional information. In addition the designers should make sure that all multi-line text fields handle carriage returns properly.
3. The designers should add navigational elements to the web forms that provide the user with indications of what steps they have completed and what steps they still need to complete.

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GUIDELINES FOR CONVERTING EXISTING COURSES INTO WEB-BASED FORMAT

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Abstract

This paper reports research in progress. It presents information in the literature on converting traditional courses into Web-Based format. The paper is divided into four parts. The first part makes an introduction to Distance Education (DE) and Web-Based Instruction (WBI) which combines features from both face-to-face classroom instruction and DE. The second part discusses current Instructional Design (ID) models for WBI. In the third part, findings from the literature on converting existing courses into Web-based format are discussed. This part includes information in the following categories: How to start the conversion to the WBI, student and instructor support, design issues, interaction among people, and assessment. In the last part, a model proposing an orderly process for converting courses into Web-Based format will be explained.

Introduction

While organizations and schools (K-12, colleges, and universities) have been using the Internet to distribute information for a long time, the implications for the instructional design and delivery of instruction over the Internet have not been sufficiently explored. Many instructors are given the task of converting existing courses into Web-based format. However, since very little has been written on this subject, instructors are left to learn the conversion process by trial and error (Lightfoot, 2000). As a result, instructors might create WBI courses equal to electronic page turning by following the traditional ID models and utilizing old methods of face-to-face delivery. This literature review will unearth the guidelines for converting existing courses into Web-based format. These guidelines will help the practitioners by offering a systematic way for conversion thus eliminating trial and error.

Definitions

In the literature, I came up with such terms as Internet-based training, Internet-based instruction, computer-based distance education, Web-based learning, Web-based distance education, and Web-based instruction. For the sake of simplicity, and to prevent confusion, I will use Web-based instruction (WBI) through the text.

Delivery of Education

Delivery of the education has changed throughout the history. Today, there are two main delivery methods: Face-to-face education and distance education (Shave, 1998).

In the industrial age, formal education system followed the factory metaphor. A campus (factory) was built and the students and teachers (employees and management) arrived at it and worked there (Shave, 1998). In this system, main delivery method for instruction has been face-to-face.

In the traditional face-to-face method the instructor can allocate time for the learners, learners can interact with other learners and with the instructor, and immediate feedback is possible. However, learning should occur at a particular time and place. Besides, interaction between the people in the learning process is difficult outside the classroom.

Distance Education (DE)

DE as a method of delivery of instruction is a promising technology, which can eliminate these problems of face-to-face method. "The term distance learning or distance education refers to the teaching learning arrangement in which the teacher and the learner are separated by geography and time." (Williams et. al., 1999).

Keegan (1980) characterizes DE with six key elements, one of which is the use of media to link teacher and learner. Different communication and media technologies can provide the link between teacher and learner.

Examples include television, computer transmission, audio or computer conferencing, videocassettes or discs, and correspondence (Heinich et. al., 1999).

In order to describe the media technologies used in DE, "The 4-Square Map of Groupware Options" model developed by Johansen et. al. (1991) provides a convenient way. This model is developed on two basic configurations that teams must overcome as they work: time and place. Based on these configurations, the 4-Square model classifies four types of technologies that support the group process. They are:

- Same time/different place
- Same place/different time
- Same time/same place
- Different time/different place

Web-Based Instruction (WBI)

WBI is a type of technology that is in the different time/different place category. The most valuable asset WBI brings to the DE field is that it allows the flexibility for learning to be occurred at any time and any place (Tipton et. al., 1998). With this flexibility, WBI can offer academic programs to a larger potential audience, which Ehrmann (1990) refers as the New Majority. These people do not have time to a full-time study on campus. For this reason, traditional face-to-face format cannot serve them. WBI may provide instruction to these people at times and places more appropriate to their lifestyles.

Many colleges and universities today are restructuring their existing courses to be offered via the Internet to target the New Majority (see, for example, Bichelmeyer et. al., 2000). As the demand grows, the number of WBI providers will increase. Besides, the number of students who have been using the Internet for communication and research is increasing in vast amounts. For this reason, it might be possible that non New Majority students also may jump to the WBI bandwagon, thus making the market even bigger.

WBI not only provide any time and anywhere delivery of education, but it also does so as effective as face-to-face education. Several researchers conducted experimental studies to compare the student performance of Web-based versus traditional class format (see, for example, Schutte, 2001, and Jones, 1999). They found higher scores for WBI or no significant difference between the two conditions. Besides the effectiveness, some course evaluations showed that WBI courses were appealing to students and students were positive about WBI (see, for example, Friedrich, 1999, and Ingebritsen et. al., 1998).

There are some other advantages of WBI. They are potential to reach a global audience (Duffy, 1992), support for multiple learning styles (Ingebritsen et. al., 1997), lower development and operating costs (Kuchinke et. al., 2001), and being a diverse information resource (McManus, 2001).

We can find disadvantages with every new innovation however and WBI is no exception. Some of the problems listed in the order of most cited are limited bandwidth (McManus, 2001), access to hardware and Internet (Shave, 1998), social isolation (Lichty, 1997), and reliance on learner (Ingebritsen et. al., 1998). Another problem lies in the conversion of delivery of instruction from face-to face to online method.

Instructional Design Model for WBI

The purpose of an Instructional Design (ID) model is "to convey key concepts and processes to be included in a particular approach" (Molenda et. al., 1996). Models tell us the critical success factors to instructional design. To be more specific, an ID model tells us what to do and when to do it, and it barely tells how to do it. Molenda et. al. (1996) point to the importance of an ID model by this example: "…experience leads the expert away from the cookbook and toward improvisation. But for the apprentice chef, the cookbook is the vital link to maintaining quality and consistency from day to day." The ID model is the cookbook that will address these concerns for instructional design.

There seems to be a lack of an ID model and conversion model for WBI. Since the Internet has not been used very long as a means for instruction, currently there are no time-proven models for WBI (Edwards, 1999). What makes this worse is the "misconception that the digital media is able to translate printed matter directly to the screen" (Lichty, 1997). Following this misconception, many instructors and designers have created ineffective WBI courses which do not utilize the opportunities Internet has offered.

Computer mediated communication supports the new paradigm of knowledge-building model for the delivery of learning. Traditional education is based upon a paradigm generally called "knowledge reproduction model." The components of this model are verbal lecture, printed handouts, drill and practice sessions, structured classroom activities, and office hours (Lightfoot, 2000). In this model, students are seen as passive learners. The purpose of teaching is to transfer static body of knowledge from its source to the student.

According to Imel (1997) the most important distinguishing characteristic of WBI is the emphasis on instruction and not just on information delivery. When information delivery is the basic concern, WBI will resemble computer-based instruction, which has been criticized as being restrained by behaviorist learning theory. WBI should be designed by basing it upon the cognitive-based theories of learning, where learners purposefully interact with the environment, actively participate, thus following the knowledge-building paradigm.

Current ID Models for WBI

Long ago, after the old king died and the prince was crowned, the crowd used to chant, "The King is dead... long live the King" to acknowledge the passing of the old king and the acceptance of the new one. For WBI, the old ID models no longer work. The king is dead. It is time to look at new models of instructional design (Hisey, 2000).

However, when we take a look into the current ID models for WBI identified by Edwards (1999), we witness that the instructional designers lament for the old king. The ID models for WBI used by practitioners resemble the old models. Current WBI models in the literature are Reeves and Reeves' model, Ritchie and Hoffman's model, and Duchastel's model.

Reeves and Reeves WBI model includes ten components for learning on the World Wide Web (WWW) called dimensions. These dimensions are (1) pedagogical philosophy, (2) learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning (9) cultural sensitivity and (10) structural flexibility (Edwards, 1999).

Ritchie and Hoffman's WBI model adapts traditional instructional design principles into WBI. These are: motivating the learner, explaining what is to be learned, helping the leamer recall previous knowledge, providing instructional material, providing guidance and feedback, testing comprehension, and providing enrichment or remediation (Edwards, 1999). In this form, this model resembles Gagne's nine events of instruction.

Duchastel's WBI model (Duchastel, 1996) proposes innovative changes to the traditional instruction model. He defines several functions in his model for WBI. He contrasts these functions with the traditional ones found in traditional teaching. These functions are specifying the goals to be pursued by learners instead of specifying content to be learned, evaluating learners at the task level instead of relying on standard testing, having learners study and work cooperatively and collaboratively instead of studying alone, producing knowledge rather than communicating it, and creating global learning communities instead of restricting programs to local interactions.

Edwards (1999) identified five recurring themes common between these three models. They are need for clear goals, including collaborative learning teams, incorporating motivational aspects into WBI, turning instructors into facilitators who provide guidance and feedback, and facilitating the production of knowledge and the development of skills in WBI.

He also developed a model for WBI based on these themes. He aimed his model specifically for higher education and adult learners, but he also added that elements of this model could be applied to any type of WBI. The basic foundations of Edward's WBI model are goal-oriented, motivational provisions, student-centered, guidance/feedback provisions, collaborative learning strategies, and project-based.

It is difficult to state that the models identified by Reeves and Reeves, Ritchie and Hoffman, Duchastel, and Edwards are design models. Their ideas include useful elements which make up successful WBI courses, but the claimed models do not tell us what to do and when to do it during the design of WBI. Therefore, there is a need for a more robust ID model for WBI.

Findings from the Literature on the Current Practices in WBI

I will summarize the practices of WBI from the literature under the following categories: How to start the conversion to the WBI, student and instructor support, design issues, interaction among people, and assessment. I found these categories by blending existing model components and by putting together common practices followed by the practitioners.

Imagine yourself driving without a road map in a remote area, which you have never been before. How would you find your way to your target? One approach would be trial and error. You could take a highway exit you strongly believe will bring you to your target. Or, you could stop by at a gas station and ask to the clerk. Whatever approach would be taken, finding your target without a map would cause you to lose valuable time and resources.

Instructional designers and instructors trying to convert their courses into WBI format without a time-proven solid model are similar to those drivers trying to find their target in a remote area without a road map. Practitioners follow several approaches in the conversion process.

Practitioners usually tend to start the conversion of instruction to Web-based format by prototyping the WBI at informational level (Lightfoot, 2000). To restate it another way, designers usually develop a site first as a supplement to the in-class course. Shave (1998) proposes four levels to use the Internet as part of a course. They are:

- **Informational (Level 1)** in which the Internet is used to provide information to students that is relevant to the administration of the class. Example information items are timetables, syllabi, and class notices.
- **Supplementary (Level 2)** in which additional resources are provided for students. Resources may include additional references and useful hints.
- **Dependent (Level 3)** in which the major components of the course are on the Internet and students need to access these as part of the course.
- **Fully On-line (Level 4)** in which the entire course and activities are on the Internet.

Friedrich et. al. (1999) go on to say that even a simple online syllabus can be advantageous for both the instructor and the student in the conversion process. These authors developed a Web site, which supplemented their graduate course in statistics and measurement. What included on this site were course syllabus, course procedures and policies, course schedule, individual units, and resources. Shotsberger (1996) surveyed existing efforts at using WWW for instructional purposes and found that most existing sites were intended as an adjunct to the classroom.

Modeling the existing Web-based courses is another start point for conversion. Modeling helps to overcome limited time and limited experience problems. Friedrich et. al. (1999) derived the basic site structure for their WBI from existing Web courses that they browsed. Ingebritsen et. al. (1998) modeled their online lectures after a face-to-face lecture experience.

Student and instructor support is an important component in WBI. Duffy (1992) states that a WBI program will not function without proper support. Student support may be in the form of an orientation. Instructor support may be provided by offering technology training to the faculty, and by creating ID teams and technical support teams.

When I started studying at Indiana University, I got an orientation from the university, from the Instructional Systems Technology (IST) department, from the education library, and etc. These orientations introduced me to the environment, to the resources, and to the important things I needed to know to be successful in my program. WBI is a new learning environment for many students and such an orientation will not only be an icebreaker to the learner but it will also show deficiencies in the WBI to the designers before actually it starts.

Kuchinke et. al. (2001) stated that eliminating as many technological barriers as possible before the beginning of the actual WBI is critical to a successful start. To do this, they offered an online tutorial and practice sessions two weeks prior to the first course in their WBI. Their tutorial included such components as practice sessions and assignments. The tutorial helped the students become proficient with all hardware and software requirements before beginning of the course. Friedrich et. al. (1999) recommends that universities must support the students and train them for online courses. This training shall be in the form of a workshop including such topics as how to take an online course, how online courses are different from classroom based courses, what skills are needed to be good online students, and etc.

A lot of studies mentioned lack of instructor experience in WBI as a problem (see, for example, Lightfoot, 2000, and Friedrich, 1999). Some authors recommended creating a permanent instructional design team and technical support team to overcome this problem (see, for example, Ingebritsen et. al., 1997, and Kuchinke et. al., 2001). These teams would consist of instructional designers/developers, and technical support staff who will act as consultants to the instructors. This consultation may be in the form of offering advice for interactivity and group activities, assisting the instructor with creation of instructional materials, providing technology resources, providing technical assistance and training, and providing troubleshooting. Teams might be located at a resource center. The resource center might also be used for placing the equipment necessary for creating and delivering instructional materials. Ingebritsen et. al. (1997) utilized such a resource center while they delivered their online course. The center they used included equipment such as various Web servers and Web authoring computer terminals, and staff such as technology specialists and undergraduate students. Kuchinke et. al. (2001) received technical assistance from a technical support team consisted of six half-time staff with expertise in Web design and development.

I will categorize design issues under three categories: Web site structure, design principles, and formative evaluation.

Lightfoot (2000) proposes that overall Web site structure should be organized into a Web tree that is wide rather than deep. Making sites that are wide prevents user from getting lost and spending excessive time looking for things. The components Lightfoot (2000) planned to include in his Web site are announcements, syllabus, course handouts, lecture notes, assignments, grades testing, and student support. He puts all these components as second-level pages under course homepage. He further goes to the third-level and defines these categories under student support: bug reports, suggestions, Frequently Asked Questions (FAQ), student discussion, text search, and other useful links. Lightfoot concludes that his implementation didn't match this plan, and it differed. What Friedrich et. al. (1999) added to these components in his WBI site are course objectives, course schedule, technical requirements and "about this site" pages.

Authors seemed to follow a common agreement concerning design principles. Lightfoot (2000) indicated that Web pages in WBI should be visually appealing, consistent, and attractive. Shotsberger (1996) added simplicity to these.

Formative evaluation is seen as an often-used method in many WBI cases to modify the design. Lightfoot (2000) viewed his WBI as a prototype and made additions to and subtractions from his initial design thus continuously evaluating it. Tipton et. al. (1998) conducted formative evaluation with students following each of the design, development, and implementation of their WBI. Changes were made to correct minor deficiencies during the formative evaluation. Friedrich et. al. (1999) indicated that optimal Web design will result from fine-tuning and several iterations of initial design.

Using synchronous and asynchronous tools is very common to provide interaction between the instructor and students and among students. Asynchronous tools used in various WBI cases include such tools as lectures (Shotsberger, 1996), e-mail messages (Lichty, 1997, and Ingebritsen et. al., 1997), and threaded discussion forums (Lichty, 1997, and Kuchinke et. al. 2001)

The most popular synchronous tool used in various WBI cases is the chat function (see, for example, Ingebritsen, 1998, and Kuchinke et. al. 2001).

When assessment is the case, some WBI cases utilized traditional tests and quizzes as a form of assessment (see, for example, Ingebritsen et. al., 1997, and Lightfoot, 2000). However, Friedrich et. al. (1999) indicated that student assessment in a Web-based course should be different from traditional techniques. They evaluated student achievement in their statistics and measurement WBI course with such authentic tasks as written reports and test construction. Kuchinke et. al. (2001) made a similar conclusion and indicated that assessment in WBI should be in performance-based mode and it should include fewer objective tests. Some authors indicated that immediate, frequent, and specific feedback is essential to provide accurate information regarding student performance (Friedrich et. al., 1999, Tipton et. al., 1998, and Kuchinke et. al., 2001).

Proposed Design Model

In this part, a model proposing an orderly process for converting courses into Web-Based format will be explained. Design models can be built in two ways; conceptually, and empirically. The following model is a combination of the information presented in the literature on this topic and the author's previous experience with WBI design. Therefore, it is a model containing conceptual and empirical elements. The model is categorized in 9 phases.

It is recommended that people using the model go phase 1 through phase 9. However, different steps might be taken in each of the phases. In addition, you do not need to implement each of the steps in the phases. For example, if you do not plan to use audio and video components in your course, you may not need to provide a facility for recording, digitizing, and editing audio and video files. Therefore, you may skip step 4.3.

Instructional Systems Technology (IST) department at Indiana University has started a three-year Master's Program to give working professionals an opportunity to get an M.S. degree in instructional systems technology field. As part of this initiative, residential courses in the IST program have been converted into WBI format. R511 'Instructional Technology Foundations I' was such a core course to be converted from residential format to WBI format. The purpose of this course is to provide an introduction to the field and profession of instructional technology. The author of this paper used the guidelines offered in the proposed design model with success with a design team to convert this course into WBI format. Therefore, the model has been used in a higher education setting for converting a course that aimed to teach concepts and knowledge. However, the model can also be utilized in other settings and learning domains.

Phase 1 - Pre WBI Efforts.

1. Infuse the technology into the course prior to WBI. This may be in the form of word processing use, spreadsheet use, e-mail use, Web use, and etc.
    1.1. In doing so, go from level 1 (informational) to level 4 (fully on-line). Designers and instructors should develop a site first as a supplement to the in-class course, in which they provide information to students that are relevant to the administration of the class. Then they should go to level 2 (supplementary level) and level 3 (dependent). After completing these stages, they should implement the fully on-line level (level 4). Following these stages will allow the parts to be implemented in chunks. In this way, the transition will be easier and lower levels will provide a base. Besides, instructors and designers will get more experience as the levels increase and they will have knowledge about potential problems and their solutions.
2. Mirror closely the content, structure and requirements of the traditional program. There must be equity between on-site course and WBI course in terms of academic rigor.
3. Model the existing Web-based courses on the Internet. The existing Web-based courses may provide the designers ideas on this issue.
4. For departmental programs (such as a master's degree program), start with core courses and add other courses by time. For this purpose, survey the faculty and ask the following two questions:
    4.1. What courses have the potential to convert to a WBI course? Some courses may not be effectively delivered via the web.
    4.2. What methods could best be used to deliver the course?

Phase 2 - Create a resource center to support on-line course development efforts.

1. Create a permanent technical support / technical assistance team. The purposes of this team would be:
    1.1. To ensure that all the technology is in place and working properly,
    1.2. To troubleshoot and provide technical assistance during course delivery,
    1.3. To identify problems and suggest solutions,
    1.4. To maintain network,
    1.5. To upgrade hardware and software,
    1.6. To implement web design and development efforts.
2. Create a permanent instructional design team. The design team might include two sub-teams:
    2.1. One group might focus on analysis & design.
    2.2. The other group might focus on development & production.
3. Provide technology training. The technology used must be transparent to both faculty and students during the implementation of WBI.
    3.1. Provide student training.
        3.1.1. Provide on-campus workshops.
        3.1.2. Provide Web-based workshops.
    3.2. Provide faculty training. Faculty should not be distracted by the technology used in the delivery process. Their task should be addressing curriculum issues instead.
        3.2.1. Provide on-campus workshops.
        3.2.2. Provide Web-based workshops.
4. Provide technology resources.
    4.1. Provide software technology. The following types of software technologies might be provided:
        4.1.1. Server software
            4.1.1.1. Web server
            4.1.1.2. Real media server
            4.1.1.3. FTP server
            4.1.1.4. Other server software
        4.1.2. Office applications
            4.1.2.1. Word processing software
            4.1.2.2. Spreadsheet software
            4.1.2.3. Database software
        4.1.3. Web design software
        4.1.4. Graphics software
    4.2. Provide hardware technology. The following types of hardware technologies might be provided:
        4.2.1. Servers
        4.2.2. Web authoring stations

    - 4.3. Provide facility for recording, digitizing, and editing audio and video files.

Phase 3 - Make an analysis. The analysis could be implemented by surveying the potential or registered students.

1. Identify requirements. Complete disclosure of requirements will help potential students make an informed decision about whether this type of learning environment is appropriate for them.
    - 1.1. Identify requirements for Information Technology (IT).
2. Make a learner analysis. Possible data sources are learner introductions or self-reports done for prior courses, learner preferences expressed in prior course evaluations, and instructors' impressions of the salient characteristics of the course.
    - 2.1. Make an analysis of technology learners possess.
        - 2.1.1. Analyze learners' hardware configuration.
            - 2.1.1.1. Memory size
            - 2.1.1.2. Processor speed
            - 2.1.1.3. Sound card availability
            - 2.1.1.4. Speaker availability
            - 2.1.1.5. CD-ROM drive availability
            - 2.1.1.6. CD-Burner Availability
        - 2.1.2. Analyze learners' software availability.
            - 2.1.2.1. Browsers
            - 2.1.2.2. Browser plug-ins
            - 2.1.2.3. Utilities
            - 2.1.2.4. Office applications
                - 2.1.2.4.1. Word processing software
                - 2.1.2.4.2. Spreadsheet software
                - 2.1.2.4.3. Database software
                - 2.1.2.4.4. Statistics software
        - 2.1.3. Analyze learners' Internet access.
            - 2.1.3.1. Connection speed
    - 2.2. Make an analysis of the venues learners learn.
        - 2.2.1. Home
        - 2.2.2. Workplace
        - 2.2.3. School
    - 2.3. Make an analysis of previous experience learners have with Information Technology (IT).
        - 2.3.1. Word processing experience
        - 2.3.2. E-mail experience
        - 2.3.3. Internet experience
        - 2.3.4. Videoconferencing experience
        - 2.3.5. Level of confidence for using IT
3. Analyze recommendations made by the stakeholders (designers, instructors, administrators, and etc.) of previous WBI courses offered in the institution (i.e., at the department, at the university, and etc.)
4. Analyze the course being converted.
    - 4.1. Analyze previous years' student evaluation data (if available) of the on-site course.
    - 4.2. Obtain a description of the previous content and approach used in the residential version of the course (The easiest way is to obtain the course syllabus).
5. Analyze the existing course management software (i.e., SiteScape, WebCT, BlackBoard, Oncourse, and etc.) and select the most appropriate one aligned with course content, and course activities.
6. Decide on pedagogy (Problem based, group work, and etc.).

Phase 4 - Identify instructional strategies. Provide students ways in which they can practice the knowledge from WBI course in meaningful ways.

1. Make the student an active participant in the learning process.
    - 1.1. Follow a student-centered model instead of teacher-centered model.
    - 1.2. Put the instructor as the mentor/supporter in the WBI model.
    - 1.3. Provide collaborative learning options to overcome isolation in distance learning.
        - 1.3.1. Provide interactivity using different forms
        - 1.3.2. Use multiple sources of information

      - 1.3.2.1. Develop partnerships to share resources.
      - 1.3.2.2. Provide access to authentic research databases.
      - 1.3.2.3. Provide access to educational resources from other colleges or universities.
  - 1.4. Utilize multiple lines of communication among participants.
    - 1.4.1. Allow synchronous communication between remote parties. The following Internet tools might be used for this purpose:
      - 1.4.1.1. Chat tools
      - 1.4.1.2. Instant messaging tools
      - 1.4.1.3. Audio conferencing tools
      - 1.4.1.4. Video conferencing tools
    - 1.4.2. Allow asynchronous communication between remote parties. The following Internet tools might be used for this purpose:
      - 1.4.2.1. e-mail
      - 1.4.2.2. Threaded discussion groups
  - 1.5. Foster interaction and collaboration among students.
  - 1.6. Allow students build informal networks for supporting each other professionally and personally. The following tools might be used for this purpose:
    - 1.6.1. Electronic café
    - 1.6.2. Phone
- 2. Support multiple learning styles.
  - 2.1. Allow students learn by seeing and hearing information.
  - 2.2. Allow students learn by doing active learning assignments.
  - 2.3. Allow students learn by reading material.
- 3. Provide problem-solving activities.

Phase 5 - Provide a well planned administrative structure. This structure should facilitate the communications and exchange between the university, the department and distance student. Although WBI students contact with the institution less frequent than conventional instruction, the interaction is more meaningful.

- 1. Provide secretarial personnel.
- 2. Provide clerical personnel.
- 3. Provide para-professional personnel.

Phase 6 – Design and develop the WBI.

- 1. Design team members should have a shared vision of how this conversion project has to come together.
- 2. Organize the development efforts with the following labels:
  - 2.1. Content Materials (the resources provided by the client)
  - 2.2. Instructional design documentation (the instructional units developed by the development team)
  - 2.3. Interface design documentation (templates, web site mock ups, sketches)
  - 2.4. Multimedia resources (multimedia components of the course and graphics)
  - 2.5. Sample documentation (examples of navigation and ID documentation from previous WBI courses)
  - 2.6. Project management documentation (production plans, roles, interim reports)
- 3. Organize the design and development team around the following roles:
  - 3.1. Project manager
  - 3.2. Technology manager
  - 3.3. Documentation manager
  - 3.4. Content manager
  - 3.5. Regular member
- 4. Meet periodically with the client to make major decisions and to update them on the design progress.
- 5. Prepare a general template and use it for each of the course modules/weeks/structure.
- 6. Balance the residential content of the course by reducing/adding the content.
- 7. Include the following components on the WBI web site:
  - 7.1. A homepage
  - 7.2. A detailed course syllabus
  - 7.3. Expectations from students
  - 7.4. Deadlines
  - 7.5. Grading criteria

    7.6. Course objectives
    7.7. Course procedures and policies
    7.8. Course schedule
    7.9. Links to course content
    7.10. Resources
8. Supplement course content with multimedia components.
9. Be consistent throughout the web site in terms of format (i.e., same PowerPoint format) and phrasing.
10. Provide documentation to the course instructor.

Phase 7 - Eliminate technological barriers as much as possible before the beginning of the actual WBI course.

1. Support and train the students for online courses. In traditional classroom instruction, students are ready to participate in the course. However, learning in a WBI course requires a set of skills, knowledge and abilities some students are not prepared for. Preparation for both technical aspects and for the distance-learning mode is necessary. In this sense, the following should be implemented:
    1.1. Provide students an orientation period (online tutorial and practice sessions) before the actual beginning of the class. These sessions will help students become familiar with the tools and techniques of online learning before the beginning of the WBI course.
    1.2. Provide students a basic computer literacy course. The following topics might be covered in this course:
        1.2.1. Multimedia software
        1.2.2. Web authoring software
        1.2.3. Conferencing tools
        1.2.4. Sending e-mail
2. Support and train the instructors.

Phase 8 – Assess the students.

1. Put emphasis on application rather than content acquisition during the assessment. Assess the student achievement with authentic assessment tasks. These authentic assessment tasks might be:
    1.1. Deliverable driven
    1.2. Discussion driven
    1.3. Presentation driven
2. Provide formative evaluation techniques.
    2.1. Utilize short answer quizzes.
3. Provide summative evaluation techniques. In doing so, use fewer objective tests than traditional settings.
    3.1. If you utilize traditional assessment techniques, allow learners to use a cheat sheet to curtail academic dishonesty.
4. Provide grades with password protection so that students can access only to their own grades.
5. Provide timely feedback on all kinds of assignments.

Phase 9- Evaluate the WBI.

1. Provide ongoing formative evaluation. Keep the features that are deemed useful, eliminate others or modify them.
    1.1. Maintain the web site regularly.
    1.2. Eliminate the bugs.
    1.3. Proofread and revise the site content. Look for typos, punctuation and capitalization problems, grammatical errors, and content that seems out of plan.
    1.4. Satisfy with the short-term results and use the initial feedback to continue with the development of the WBI.
    1.5. Survey students regarding their perceptions of the WBI. For this purpose, use a method that allows students to make anonymous comments on the class while the WBI is underway.
    1.6. Test the site across different browsers and computer platforms (Windows and Mac).
2. Calculate potential savings by converting the courses to WBI mode, and Return on Investment (ROI). Effective WBI courses require the allocation of a variety of resources. These resources make up the overall cost of the WBI course. In return, the institution expects benefits as the result of the investment. If benefits exceed costs, the WBI course can be considered as a viable academic alternative.

Conclusion

This literature review showed that without a time-proven WBI model, practitioners have been trying to convert existing courses into Web-based format. Since they do not follow a common model, there seems to be an inconsistency in the approach taken. Everybody is trying to do something, but they are losing valuable time and resources. There is an absolute need for a solid model for both WBI and conversion of instruction to Web-based format.

Although practitioners did not follow a common model, their conversion of instruction to Web-based format included some common categories such as how to start the conversion, how student and instructor support should be, design issues, how interaction among people should be, and how assessment should be. Examples for each of these categories were given.

There are more to issues to cover in this study such as collaboration, administration, and other situationalities. However, limited space and time does not permit to cover all of them. Since this is a research in progress such issues will be extended in the future.

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Web-Based Continuing Education: Models and Methodologies

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Introduction

In 1998, the Department of Education implemented "principles of effectiveness" requiring that all Safe and Drug-Free Schools and Communities (SDFSCP)-funded programs be research-based. To help schools identify and adopt research-based drug and violence prevention strategies, the 1999 Safe and Drug-Free School appropriation of $566 million included $35 million for the first year of a new Middle School Drug Prevention and School Safety Program Coordinator initiative.

This new initiative supports the hiring and training of full-time Middle School Coordinators (MSCs) to oversee implementation of drug prevention and school safety programs for students. Specifically, MSCs are expected to:

- Identify research-based drug and violence prevention strategies.
- Assist schools in adopting the most successful strategies.
- Develop, conduct, and analyze assessments of school crime and drug problems.
- Work with community agencies and organizations to ensure students' needs are met.
- Encourage parents and students to participate in the identification and implementation of research-based prevention efforts.
- Assist in the development and implementation of evaluation strategies.
- Identify additional funding sources for prevention and school safety programming.
- Provide state education agencies feedback on successful programs and activities.
- Coordinate with student assistance and employee assistance programs.

To help recently hired Middle School Drug Prevention and School Safety Coordinators meet the roles and responsibilities of their new jobs, the U. S. Department of Education, Safe and Drug-Free Schools contracted with Education Development Center (EDC) and its partner Social Science Research (SSRE) to create a national center for training and assistance.

Schools and communities face an urgent challenge to design effective solutions to the complex problems of violence, alcohol, tobacco, and other drug use. To assist schools in the selection and implementation of effective prevention programs that are responsive to their needs, the U. S. Department of Education has undertaken several initiatives designed to enhance schools' understanding of what works and expand the inventory of effective programs. Among these initiatives is the Safe and Drug-Free Schools Middle School Drug Prevention and School Safety Coordinator Program, which supports the recruiting, hiring, and training of one or more full-time staff for three years to guide the implementation of drug prevention and school safety programs for middle school students.

A well-trained, full-time coordinator who is familiar with the research on effective prevention programming and who bases programming on sound planning that involves assessment, measurable goals and objectives, effective research-based strategies, and evaluation, should be able to implement prevention programs that better meet the needs of the students in their schools.

Coordinators, however, face several challenges to implementing effective prevention programs: determining which strategies and programs are effective at reducing substance use and violence among young adolescents, monitoring program activities implemented in the school; community members who do not believe there are drug problems among their youth; and other school district priorities that-while they may be desirable for other reasons may interfere with prevention efforts.

The goal of the Training Center is to work with middle school coordinators through face-to-face trainings and web-based continuing education to enhance their understanding of research-based programs and equip them with the skills necessary to identify research-based strategies based on an assessment of needs in their district.

The U.S. Department of Education's Safe and Drug-Free Schools and Communities Program (SDFSCP), funded under Title IV of the improving America's Schools Act of 1994, provides funds for virtually every school district in America to support drug and violence prevention programs.

Background

Three online continuing education events for United States Department of Education Middle School Drug Prevention and School Safety Coordinators were held between April and June 2001. The purpose of these events was to provide a menu of skill-based, interactive learning activities that supplement the core training workshop (see Harding and Formica 2000).

One hundred and eighty-six (186) of the 634 MSCs (29%) who participated in the five-day core training workshops registered for at least one of the three online events. Other events will be offered in the future.

This report summarizes evaluation findings across the three online events. Separate reports presenting evaluation findings from each of the events are also available (see Harding and Formica 2001a, 2001b; Formica and Harding 2001).

Goals and Content of the Online Events

The three continuing education online events were intended to: (1) provide support for the implementation of best practices that enable organizational change, (2) build on the foundation established by the five-day core training, and (3) foster the exchange of information and ideas that can transfer knowledge into practice.

Each of the continuing education online events is designed and sequenced to assist MSCs in addressing a set of critical factors for the successful implementation of effective prevention programs: (1) assessing local needs and assets, (2) designing programs to meet desired results, using measurable goals, (3) selecting and implementing programs that are based on research, and (4) evaluating and refining program efforts.

The first online continuing education event, "Using Existing Data in Your Needs Assessment," was designed to help MSCs locate and use available local, state, and national data to determine drug and violence prevention priorities and select prevention programs for their schools and communities.

The second continuing education event, "Identifying Priorities and Strategies for Your Prevention Initiative," was designed to facilitate the development of a comprehensive prevention plan. This event targeted MSCs who had collected information about local needs and were in the process of collaborating with school and community partners to translate community data into prevention priorities and long-term outcome statements, and to identify research-based strategies that will help achieve those outcomes.

The third continuing education event, "Promoting Prevention Through School-Community Partnerships," was designed to provide MSCs with tools and resources to build school-community partnerships that will support and enhance their overall prevention initiative.

Organization and Structure of the Online Events

Each of the online events consisted of seven components: (1) an introduction, (2) a set of clearly defined skills and strategies to be addressed, (3) a set of methods, materials, and timelines, (4) structured activities, (5) discussion areas, (6) an event summary, and (7) client self-assessment and evaluation surveys. The models used to structure the events included:

- *Library Model*: This includes access to online resources such as journals, reading lists, websites, and other subject-related sites rich in relevant information
- *Textbook Model*: This model includes the use of course and lecture, slide presentations, and other class-related documents in various media formats.

- *Computer-mediated Communication Model (CMC):* This model features collaborative learning for communication and eliciting feedback through the use of asynchronous and synchronous interaction with a facilitator or moderator.
- *Virtual Classroom Model*: This model includes the three aforementioned models plus additional elements of interactive, computer-based instruction such as simulations, games, and various forms of synchronous interaction.

These models were used in various combinations for each event with the predominate mix being that of the library, textbook, and CMC models.

Evaluation Methods

Coordinators were asked to complete a post-event online survey. These surveys asked MSCs to provide demographic information, rate the overall online events and the different aspects of the events such as the quality and usefulness of the information provided, answer true/false knowledge items about event content, and answer self-report knowledge gain items. The surveys also included several open-ended items that allowed coordinators to report the most and least helpful features of the overall events and to write any additional comments or suggestions.

For the purposes of this summary report, statistical analyses were run on the data collected from the three different continuing education online events to determine whether or not there were any significant differences in the responses given by the coordinators. Results of these analyses (ANOVAs) support combining responses across all three online events. Additional analyses were conducted to determine whether any differences existed between active participants and auditors, and whether participation in multiple events was more beneficial that participation in a single event.

All instruments used to evaluate the events were submitted to the Office of Management Budget (OMB) prior to the events to receive approval under the 1800-0011 Master Plan for Customer Surveys and Focus Groups.

Results & Discussion

In general, results concerning participants' satisfaction with the three five-day continuing education online events were very positive. On a web-based post-event survey completed after participation in each of the online events, coordinators were asked to rate their overall satisfaction with the online events on a 5-point scale: Very Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, and Very Satisfied. Eighty-two percent (82%) indicated that they were either "Very Satisfied" (42%) or "Somewhat Satisfied" (40%) with the online events. Participants were also asked to indicate whether or not they would recommend the online events to other MSCs, how much new information/ideas they received through participation in the events, and the usefulness of the information discussed during the online events. These results were also very positive. Eighty-eight percent indicated that they would either "Strongly Recommend" (46%) or "Recommend" (42%) the online events to other MSCs, 79% indicated that they received either " A Lot of New Information/Ideas" (27%) or "Some New Information/Ideas" (52%), and 87% indicated that the information discussed during the online events was either "Very Useful" (43%) or "Somewhat Useful" (44%).

Participants were also asked to rate their satisfaction with five elements of the online events on a 5-point scale: Very Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, and Very Satisfied. Eighty-seven percent indicated that they were "Somewhat" or "Very Satisfied" with the quality of the materials, 84% with the organization/layout of the event website, 83% with the download speed of the web pages, 82% with the links provided to other websites, and 70% with the role of the online facilitators.

Additional analyses were conducted comparing active participants versus auditors. The differences between active participants and auditors were both small and statistically not significant for the amount of new information they acquired, the usefulness of the information they received, and the time they spent on the events, the true/false items tailored to each event, overall satisfaction with the events, and willingness to recommend the events to other MSCs. However, although non-significant, auditors did report that they gained more knowledge for all of the dimensions assessed for events two and three.

As mentioned earlier in the report, the online courses were originally designed such that there was a very clear distinction made between active participants and auditors. In reality, the differences between the two groups were very minimal. Given the lack of distinction between the two groups, it is not unexpected to find that they did not systemically differ on the majority of the dimensions assessed. Unfortunately, this limits our ability to assess with any certainty whether or not the additional components received by active participants (e.g., facilitated discussion areas) had a more positive effect on these MSCs or whether these additional components made no difference. In light of the high level of performance and satisfaction measures across groups, we might assume that *both* groups benefited from these additional components, but further research with more precise distinction between groups is needed.

A second set of analyses compared MSCs who participated in multiple events with those who participated in only one event. In general, participation in multiple events was associated with higher levels of performance and satisfaction with the events. For example, MSCs who participated in multiple events were significantly more likely to indicate that they received more information from the events and more apt to report increases in knowledge gained ($p<.05$).

Although not significant, MSCs who participated in multiple events were also more likely to rate the usefulness of the information, the ease of navigation, the ease of use of the discussion/chat area, overall satisfaction with the event, and willingness to recommend the event to other MSCs more highly than MSCs who participated in a single event.

While the different online events are designed to be mutually exclusive of one another, there is a certain degree of overlap and a logical progression of themes from needs assessment through identifying priorities to building partnerships. The pattern of results for MSCs who participated in multiple events, especially the significant increases in information received and self-reported knowledge gain, is consistent with the cumulative nature of the different events. In addition, the format and timeframe for the events (one week with 50 active participants and an unlimited number of auditors per event) suggest that further studies examining alternative designs for continuing education web-based events for adults is warranted. These findings also suggest that it is important to encourage MSCs to participate in multiple events.

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Distance Learning and Student Strategies

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Abstract

This paper reports the results of a two-part qualitative study into student strategies for learning in distance learning courses offered at Teachers College, Columbia University. Verbal Protocol Analysis was used to gather information on the cognitive strategies students used to solve problems encountered as they navigated through the site. A semi-structured interview was also conducted with participants to gain insight into student attitudes and perspectives on learning in the online environment. The theoretical framework of Activity Theory was used to develop a deeper understanding of the systemic roots of tensions in the online classroom environment. Conclusions include suggestions for specific teaching practices and design solutions to alleviate these tensions.

Introduction

Online education is a relatively new phenomenon, which is increasingly seen by institutions and educators as a viable alternative to the traditional face-to-face class. Past research into online education has focused primarily on media comparison studies. These studies have generally resulted in a 'no significant difference' finding, which Lockee, Burton and Cross (1999) have criticized as useless research, "...failure to reject the null hypothesis means just that and nothing more; just as a legal finding of not guilty does not mean innocent." (Lockee et al. p. 38). Studies that rely on comparing achievement on classroom assessment measures between in-person courses and online courses tell us nothing about the actual effect of the distance learning media on the experience of the individual learner. McIsaac and Gunawardena (1996) recommend that future research focus, in part, on "Examin[ing] the characteristics of the distance learner and investigat[ing] the collaborative effects of media attributes and cognition" (p. 431).

The need for further and more focused research was reiterated by Harasim (1996) who claimed that it was no longer necessary to prove the viability of educational computer networking; rather, further research should study the learning processes in online environments and "the patterns of human interaction in decision-making, problem-solving, and knowledge building."

Therefore, this qualitative study departs not with the goal in mind of trying to prove or disprove the effectiveness of the online medium, but rather from the assumption that the Internet is a viable delivery mechanism, and the design of Internet-based programs needs to take into account the processes and strategies used by the learner in order to increase effectiveness.

Methodology and Analytic Framework

This pilot study used a grounded theory approach (Glaser and Strauss, 1967) to qualitative research in order to find patterns and strategies for learning that emerge from the learner's perspective, using the process of sorting, coding and comparing the data collected in interviews and observations of students enrolled in online courses through Teachers College Distance Learning Project (DLP). Two online platforms are used in the DLP, Blackboard and Prometheus. These commercial educational web site templates provide a course structure for teachers as well as communications tools to facilitate interaction.

Engstrom's Activity Theory model was used as the framework for analyzing student behavior in the online environment. Theoretical propositions concerning the components of successful online course design emerged from careful analysis of (i) the behaviors and attitudes students demonstrate as they move through their online course; (ii) the level of interaction between the learner and the different aspects of the online course; (iii) the steps and decisions that the learner makes while navigating the course site.

Procedures

Using a technique known as Verbal Protocol Analysis (VPA), based on Ericsson and Simon's "Thinking Aloud Processes" (1993:78), the participants were instructed to verbalize their thoughts as they navigate through the course web site. This process was captured on videotape by placing the camera behind the participant and focusing on the computer screen, while a microphone recorded the speech. The purpose of the verbal protocol analysis was to observe what actually happens when students participate in an online course, and to reveal—as they happen—the points at which students make decisions which will potentially affect their learning experience. During a semi-structured interview, the participants were asked to reflect more deeply on their actions as exhibited during the VPA task.

The think-aloud technique requires the participant to verbalize her thoughts as she works through a cognitive task. The procedure is designed to reveal the cognitive processes the participant is undergoing as she performs the task. Social verbalization includes explanation and description of one's thoughts while performing a task. Social verbalization is distinct from think-aloud through the addition of explanatory and descriptive elements. In order to minimize the amount of social verbalization and maximize the think-aloud activity, the researchers executed the following procedure as outlined by Ericsson and Simon (1993):

> First the experimental situation is arranged to make clear that social interaction is not intended, and the experimenter is seated behind the subject and hence is not visible. The "think-aloud" instruction explicitly warns the subjects against explanation and verbal description. Second, after the instruction is presented, the subjects are given practice problems in which it is easy to verbalize concurrently and from which they attain familiarity with the normal content of think-aloud verbalizations (p. xiv).

The participants were instructed to verbalize their own thoughts, they were told not to explain anything to the researchers and that in fact there would be no interaction during the think-aloud unless the participant grew quiet, at which point the researcher would prompt the participant to "keep talking." The participants were given a math problem and a language problem to solve (Appendix A), as a way to practice the think-aloud technique. The think-aloud procedure is difficult for individuals to execute. According to Ericsson and Simon (1983) "When an investigator instructs a subject to think-aloud, some subjects may misunderstand the instruction and produce instead the more common social communication, explaining or describing the process to the experimenter" (p. xiv). The participants in this study produced both social communications, explaining and describing the web site to the researchers, and true think-aloud verbalizations. However, the information that was received from the participants is rich data, which reveals much about the online educational experience for them.

After the think-aloud section of the experiment, brief interviews were conducted with each participant. The interview sought to uncover further information about the approaches to learning the participant employed in the online course. The interview also posed questions about the social aspects of the experience.

Sample

A total of four participants took part in this pilot study. The participants voluntarily took part in the study and they represent a convenience sample of students taking online courses at Teachers College in the spring, 2001 semester. The four students were all enrolled in different courses. The results of the study are not generalizable to a larger population and serve mainly to provide insight into the experience of the individual participants. Table 1 contains the ethnographic and questionnaire data obtained from the participants. Participant names are fictitious.

Table 1

Participant	Degree Program	Age	Sex	Ethnicity	How many online courses have you taken (including this one)?
Karen	MA Sociology & Education	30	F	White/Latina	One
Myriam	Ed.M. International Ed.	32	F	Latina	One
Ann	MA Sociology & Education	25	F	White	One
Jean	Not enrolled in Degree Prog.	48	F	White	Two

Findings

Several important themes emerged from the analysis of the transcripts including: web site design flaws; the use of cognitive strategies and coping strategies; the effects of virtuality; and the effects of learning differences in the online classroom. These themes have important implications for future design on online learning environments, and each theme on its own could be the focus of future research.

Web Site Design Flaws

Each participant expressed some confusion regarding orientation to the organization of the class and the flow of the syllabus. The participants attributed this confusion to the instructor's layout of the course materials in the online environment. Ann experienced the most bewildering design of all four participants. The online course she took used three different web sites, with three separate URLs to convey the subject matter (Professor's self-created web site), conduct the online discussions (Prometheus platform) and hold the synchronous chats (Blackboard platform). During the think-aloud section Ann made mention of the difficulty in navigating through the various sites associated with the course six times. The Professor's self-created web site was particularly frustrating for Ann. Among the many navigational problems with this web site, the Professor used a moving JavaScript window as a menu bar. This box moved down the page as the viewer scrolled down, obscuring parts of the web site that the viewer wished to see. In the interview section Ann expressed the desire for a more transparent design. "I wish they all would have been on the same web site. I wish there would have been like a way to directly link between. It took me a long time just to remember the names [URL's]." This course design was a source of frustration for Ann, which unnecessarily interfered with the learning experience.

Karen also experienced confusion and frustration with the layout of the course. The course Karen took was presented using the Blackboard platform. Karen stated during the think-aloud, "but this is where its really confusing because, I'm here and this is called equity, this week's called equity, but if you go back to course documents where it gives us the readings to prepare for class you don't see anything listed as equity." As Karen made this comment she was jumping back and forth between the *Communications* section of the site and the *Course Documents* section of the site in an attempt to figure out which discussion topic corresponded with the current week's readings. The lack of consistent labeling between the course documents section topic listings and the corresponding discussion forum in the communications section was a design flaw that caused problems for Karen. To cope with the disorientation she described, Karen developed the strategy of referring to the contents of the student discussion for clues as to what the current topic of study was.

Use of Cognitive and Coping Strategies

Karen used this strategy—referring to the work of other students—to solve problems she encountered in the online environment, for both organizational and educational purposes. Karen scaffolded her own comprehension of assigned texts by first reading the comments of others in the discussion board which referred to these assigned readings. "I would usually go and read what other people have written and then go actually do my reading for the week" and "I usually read them [other people's comments on the discussion board] so I kinda have an idea of what people are talking about before I do my reading." This strategy provided Karen with a meaningful overview of the material to be read. The focus of the conversation in the discussion forum alerted Karen to the nature of the content of the material to be read and to what her fellow students found most noteworthy as a topic of discussion within the readings. This strategy is akin to the notion of advance organizers postulated by Ausubel et al. (1978). As Driscoll (1994) summarizes, "Advance organizers are relevant and inclusive introductory materials, provided in advance of the learning materials" (p. 126).

Each of the participants in this pilot study mentioned their own referral to other student's work as a method of learning in the online environment. Ann and Karen were both enrolled in theoretical courses. Ann reported during the think-aloud "If I don't understand the question from over here, sometimes I go in and find out what other people have written about it." Ann's strategy is similar to Karen's; that is, the thoughts of classmates are used to scaffold reading assignments and gain clarification on the topic question at hand.

Myriam and Jean were both taking design courses. They would look at other student's design ideas to help spark their own creative imaginations. Myriam remarked:

> I'm learning from my classmates in terms of...when I know there is an assignment going on or something, in the process of doing it, I check what they [the other students] have been doing so I learn from that 'oh wow that's a good idea.'

Likewise, Jean mentions, "I want to look at other students work. This is work I've not done yet. I may just get an idea."

It is possible that Karen and Ann could apply their strategies in a face-to-face class; they could listen to the class discussion of the readings for the week and then do the readings subsequent to the class. However, the online environment provides a concrete and consistent source of student input. Moreover, it is highly unlikely that Myriam and Jean could have access to fellow student's designs in a face-to-face class. This is a unique affordance of the online course for Myriam and Jean.

Another strategy that was deployed by all of the participants was the coping strategy of printing out course materials (such as lecture notes and electronic texts) to read off-line. The commonly used cognitive strategies of highlighting, underlining or otherwise denoting important sections of a text are not readily available in a computer-based environment. Both Jean and Ann expressed the desire for a highlighting tool that would allow them to take notes in an electronic text the way they normally would with pen and paper. According to Ann "It's kind of strange reading text on the screen as opposed to reading books. It's harder to go back and there's not the ability to highlight and underline and figure stuff out, which is what I'm used to doing."

These actions showed that students are coming up with strategies to cope with the unfamiliar attributes of this new learning environment, and even discovering new ways to learn their course materials as a result. Thus it is useful to differentiate between 'learning strategies' (advanced organizing), and 'coping strategies' (printing course readings) as two observable types of behavior. The former can be described as a deliberate action that contributes to learning the course content, but which may be the same as a strategy used in face-to-face courses. The latter, a coping strategy, is an action exhibited by the participants that is used to compensate for an unfamiliar and unique attribute of the online experience. In many cases an action could be both a coping and a learning strategy, or more importantly, the coping strategy often becomes that which contributes to learning the course content. We will see other examples of learning and coping strategies throughout our findings.

Effects of Virtuality

The fact that one is not able to utilize well-known cognitive strategies in the online environment is a negative effect of virtuality. The virtual nature of the online course gives it certain characteristics not found in a face-to-face class. Freed from temporal and spatial boundaries, the online course may be accessed at anytime, from any location. Social interaction in the virtual environment is largely relegated to textual exchanges on the discussion board, in the chat room or through email. Body language, eye contact and physical appearance are communicative modes not available in the online course. These aspects of virtuality have an effect upon the student experience. The participants reported both positive and negative effects of virtuality. The synchronous chat was Ann's favorite aspect of the online learning experience. Ann emphasized the way the chat format allowed her to have more participation in the class due to the suspension of the "social rules" at work in the face-to-face classroom.

> [T]here's something about getting up and speaking forth your idea – which you're not even sure [of] because you are still formulating – in front of people that is scary, that is intimidating, especially if you don't feel like you know the people in the class, have a good rapport with everyone. Whereas the first evening of the chat it took a little bit for me to jump in there and put forth my ideas, but it was fine after that, and once I felt like I had a place in the conversation, it was a lot easier to talk.

Ann found the "organic, nonlinear" nature of discussion in the synchronous chat room to be a compelling learning activity:

> It's amazing what a different kind of activity the learning process is, because you are constantly having all these conversations with people um and that – you have to jump in, you have to participate – you can't just sit back. People respond to a thread and then another thread develops from it and then its more organic, it's a lot less linear.

Moreover, the dilemma posed by 'having to jump in' to a synchronous chat turned into an opportunity for Ann to learn the content better, because she began preparing for her chat by reading and reviewing her course materials in detail before the chat session. This is an example of a coping strategy that becomes a learning strategy as well.

Interestingly, it is the lack of proximity that allowed Ann to feel more confident in the class. She felt like she got to know the students in the online class in a way that she seldom did in a face-to-face class: "You have a sense of people who have similar ideas, you have a sense of people, what people's interests are, I feel probably that I know people in the class better than I would know people in a regular class."

However, lack of proximity was also the major negative effect of virtuality cited by the participants. The feeling of isolation and the lack of getting to know the Professor and the other students in the class was a common issue. Myriam remarked: "I feel that I'm like maybe too much by myself. I don't like that part. I don't feel like I have that much feedback and I'm sometimes I feel like I am lost."
Jean also mentioned that she did not like interacting by e-mail and that she missed the "spontaneous" nature of face-to-face communication. "Personality wise I like to see faces, you know. I move my hands when I talk. It's easier. You are more spontaneous when you interact directly. I think it is difficult to interact by e-mail." Even Ann noted that she made a point to go by the Professor's physical office in order to meet him. "I actually went by and introduced myself to him because I thought it was kind of strange to be taking the course without ever having set eyes on him."

Karen expressed the most difficulty with the effects of virtuality. The collapse of time and space boundaries manifested in the anytime, anywhere nature of the online class was a very troubling aspect for her. She consistently lamented the lack of face-to-face elements in the online class. Her dissatisfaction with the online experience seemed to be inversely proportional to her expectation that this modality would be similar to a traditional face-to-face class. In both the think-aloud section of the session and the interview section, Karen implicitly and explicitly expressed confusion, frustration and difficulty with both the collapse of time and space boundaries and the virtual aspect of the online environment.

> Like the week starts on Sunday, so these classes are actually seven days a week, whereas I'm used to thinking of school between like Monday and Friday. It's like this, people post on the week-ends so it's just even more work it's just : it's like its ongoing it's never complete.

Karen further explicated this sense of feeling overwhelmed in the following passage:

> [P]eople add new ones [comments to the discussion forum] after that week is over, which is confusing for me. Because like : 'classroom community' was, you know, three weeks ago and: there's 47 new [comments on the discussion topic], and that week I read them all, but like what are people still talking about?

Karen's frustration with the ongoing nature of the discussion in the online classroom revolves around the extra amount of work entailed in keeping up with several discussions.

> It's like by the time we get down to the end of this class we're gonna have to read everything it's gonna take like hours to go through and read everyone's responses and how responsible are we supposed to be for all of this? In a normal class you just go each week and the topic would be equity and you only have to be responsible for that.

The fact that students can access the conversation at any time during the week and the fact that they could still contribute to the conversation after the class had moved on to the next topic is a crucial difference in the online and face-to-face experiences. The opportunity to read and re-read comments in the student discussion board creates a whole new learning opportunity for students in the virtual classroom, but they must first learn to abandon their previous temporal and spatial notions of classroom learning.

In the interview section of the session, when asked how she approached learning in the online course, Karen responded "Well, I try to fit it into the schema that I think of as a normal class. And it doesn't really seem to fit." The fact that Karen came to the online class with the traditional face-to-face class schema is a deducible one. Few students at this point in time have much experience with online education, so the primary conception of class is the traditional face-to-face mode.

In line with this schema, Karen expresses her preference for the proximal pleasures of the face-to-face experience. "I like going to class, I like listening to discussions, I like being in the room having that moment in time with a group of people discussing ideas." She also expresses her frustrations with the virtual nature of the online class. "I feel like I'm faking the class, I don't feel like I'm really taking it. I mean I'm doing the readings, but its such an isolated experience." The lack of proximity appears to result in less meaningful learning for Karen:

> Whereas when, online I might be reading twelve comments in a row and so your click, click, click commenting. I forget what the other people said and it kind of starts to blend together. Whereas, when your in class you see the person who said it and that's what you want to remember, even though three more comments come in between you might go back and say I remember what Susan said blah blah blah blah blah. Because she's right there, its in the moment, its an interaction.

It is possible that Karen uses visual cues to encode new information. In a discussion of human memory and retrieval Anderson (1995) explicates various contextual cues individuals use to encode information. Karen seems to use the visual cue of other speakers' physical appearance to help her encode information in a class. The comment above implies that by remembering who spoke, Karen also remembers what it is the person said. Therefore, the lack of such visual cues in the online environment could prove to be a true impediment to cognitive functioning for Karen.

Jean also sited the lack of visual presence and identification of her classmates as an issue, but one that she was able to cope with by making connections between students' personal profiles and their course participation. For her it wasn't enough to read only the names of those participating in the discussions, or what they had to say. She needed to find out who they were, what they did for a living, and construct a personality with the available clues. These included not only the personal information students posted about themselves online, but also their style of writing and project participation. While looking at her classmate's projects, Jean remarked "You can really see the personality of the student, the way I imagine him" and "He likes to be funny, this Mark."

This value placed on getting to know the other students was also a coping strategy used to compensate for the lack of face-to-face interaction as found in the on-campus course. Jean knows that there are other people who are experiencing the course and working on the assignments just like she is. By recalling personal facts about each classmate as she reads their work, Jean is able to synthesize otherwise disjointed bits of information into a coherent set of content, thus her coping strategy also contributes to the learning process.

Learning Differences

Karen is a student in a degree program at Teachers College, and she comes to campus regularly for courses. It happened that this course wasn't offered on campus this semester, so she had to take it online. The fact that she did not choose the online environment no doubt contributed to her significantly negative attitude towards the experience, but she also described herself as a social learner, and a vocal person overall, who learns best in groups. Karen made frequent comments about her preferred way of learning and defined herself as a "traditional learner." One of the most important learning outcomes Karen felt she experienced from her online class was the appreciation and empathy she developed for students in her first grade class who have differing learning styles. "It helped me to be a better teacher in that I'm more understanding of my students who have learning differences."

Karen's point about learning differences is crucial for understanding student behavior and performance in the online learning environment. Her assessment of herself as a traditional learner may have inhibited her from taking full advantage of the affordances of the online medium. Throughout the think-aloud, Karen made comments such as the following. "I feel like there is probably an easier way to be doing this class than I'm doing it, but like I'm always doing it this way, where I'm not quite sure what we're supposed to be reading or doing." However, she also found ways to utilize the affordances to her advantage, such as the aforementioned strategy of reading student comments on a topic as if they were an advance organizer. She also noted that the ongoing nature of the student discourses would be useful if "you want to write a paper on that topic or something."

Had Karen been able to adapt her learning style to the online environment, she might have had a very unique learning experience, much like the one Ann quite unexpectedly had herself. Ann is also a student in a degree program on campus, but she works full time and takes only one other class. The on campus section of the course that she is taking online was offered on a different day than the other course she took on campus, and so rather than coming to campus two days per week, she decided to enroll in the online section of the course. Therefore, unlike Karen, the choice to take an on line course was a convenience, and so she may have entered the experience with a more positive attitude. Whereas Karen relied on the structure of the in class course, Ann found that structure too limiting, too linear. "I feel when you are in a class there are a lot of rules that people follow," for example, one person talks at a time, students don't interrupt each other, they follow the train of thought that the last person said. Furthermore, Ann described herself as shy in class, and she felt less inhibited online, whereas Karen described herself as a very vocal person, who felt she couldn't be heard online.

Ann adapted to the online experience in many ways. For example, technologically, she found innovative ways to work with multiple browser windows, which was a coping strategy used in the online chats so that she could refer to her notes and the Professor's Website at the same time. Ann was particularly pleased with the online chat feature of her course, which proved to be the activity that transformed her learning experience and her beliefs about learning. Ann reported that the online learning class "broke me out of what I would normally say learning was in the regular classroom…I'm kind of doing a lot of it independently."

Another example of the independent nature of online learning is the asynchronous discussion board feature of her class. Ann noted that it was challenging to be on her own and required to write short-answer responses to thought-provoking questions: "I hadn't had anyone to talk to about those issues...it was me doing it on my own ...trying to come up with links between pieces." Making connections is something that was normally done in class, by the Professor, or by other students asking questions. Ann was willing to take risks in the course and with her own participation, which may have made all the difference in transforming the negative feeling of isolation into a positive feeling of independence.

The online class experience created many potentially frustrating tensions for the participants. The tensions arose not just from a lack of inexperience with the online medium, but also from the whole of the system itself. This assertion is evidenced in the data -- poorly laid out course materials, collapse of time and space boundaries, the virtual nature of interaction, isolation -- all of these elements contributed to the tensions the participants experienced.

Activity Theory

Activity theory provides a lens through which we may view the whole of the system and begin to understand, through analysis, the causes of the tensions reported in the findings. This analysis also makes possible the derivation of ideas for adjustments to the system that will result in the easing of these particular tensions. Activity theory has great potential for the refinement and efficacy of practice in any system -- educational, organizational or social.

Activity theory developed from the work of Soviet psychologists Vygotsky and Leont'ev, who were both greatly influenced by the philosophical writings of Marx and Engels (Engestrom, 1999). Activity theory constitutes an analytical framework that stresses the importance of a cultural-historical and dialectical approach to the understanding of human activity and societal or systemic change. Vygotsky (1978) articulated the need for a new approach to understanding human activity thusly:

> All stimulus-response methods share the inadequacy that Engels ascribes to naturalistic approaches to history. Both see the relation between human behavior and nature as unidirectionally reactive. My collaborators and I, however, believe that human behavior comes to have that 'transforming reaction on nature' which Engels attributed to tools. We must, then, seek methods adequate to our conception. In conjunction with new methods, we also need a new analytic framework (p.61).

These ideas were expanded upon by Leont'ev (1978) "...activity is not a reaction and not a totality of reactions but a system that has structure, its own internal transitions and transformations, its own development...In all of its distinctness, the activity of the human individual represents a system included in the system of relationships of society." (pp.50-51). The definition of human activity as a multi-directional, societally embedded, transformative system stands in direct contrast to the western notion of the autonomous individual, which is perhaps the reason why activity theory has only recently gained attention in the west. However, in the last two decades western educational researchers have begun to utilize activity theory as an analytical framework for understanding participant activity in educational and organizational settings.

Engestrom has led the way in adopting an activity theoretical approach to the analysis of such settings, and has contributed to the further development of the theory by creating a model of an activity system that can be readily applied by researchers. According to Engestrom and Miettinen (1999) "Minimum elements of this system include the object, subject, mediating artifacts (signs and tools), rules, community, and division of labor" (p.9). The last element of Engestrom's model is the outcome of the activity system. Barab (2001) notes "Activity theorists are not simply concerned with doing as disembodied action but are referring to doing to transform some object, with a focus on the contextualized activity of the system as a whole" (p. 2). In this clarification, the outcome is the transformed object. Barab (2001) continues:

> By subjects, activity theorists are referring to the individuals or groups whose agency is selected as the point of view for the analysis. Objects can be conceptual understandings, raw materials, or even problem

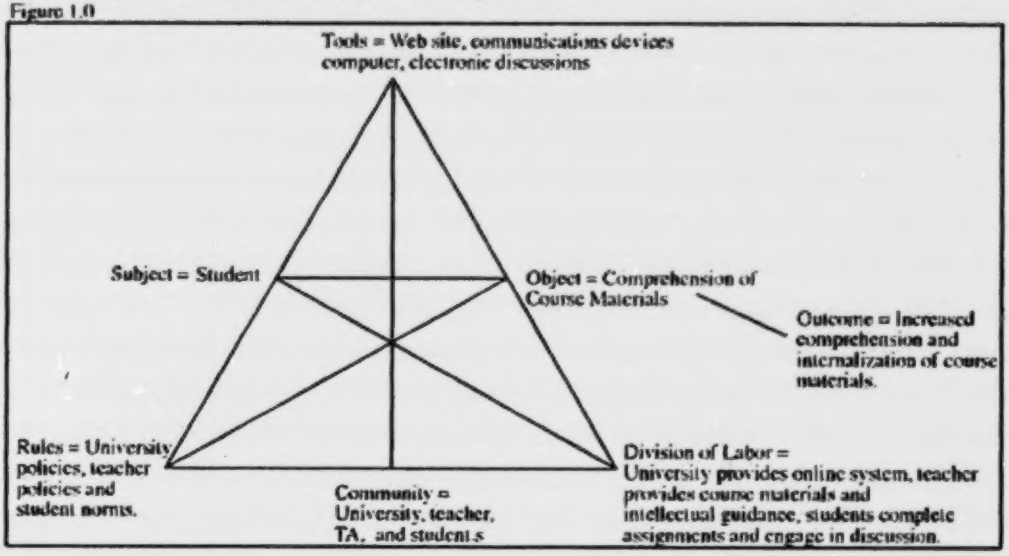
spaces 'at which the activity is directed and which is molded or transformed into outcomes with the help of physical and symbolic, external and internal tools.' (Engestrom, 1993, p. 67)" (p. 2).

The historicity of the activity system is an important concept in the analytical structure of activity theory. As Vygotsky (1978) notes "The psychological development of humans is part of the general historical development of our species and must be so understood." (p. 60). Engestrom (1999) defines the notion of historicity in the context of activity theory as "identifying the past cycles of the activity system." (p. 35).

Three principles govern the interpretation and analysis of data when a researcher takes an activity theoretical perspective: 1) the activity system as a whole is the unit of analysis; 2) the history of the activity system must be taken into account; and 3) contradictions within the activity system can be analyzed "as the source of disruption, innovation, change, and development of that system, including its individual participants" (Engestrom, 1993 p.65). The analysis of the participant's experience in the online class is based on these three principles.

The first task is defining the elements of this particular activity system. For the purposes of this paper, the student participant is the subject of the activity system. In a different analysis, the teacher could be taken as the subject, or the class as a whole could be taken as the subject. This shift in emphasis would necessarily produce different results; how significant this difference would be is unclear. With the teacher as the subject, both the object and the outcome would change; however, the rest of the elements of the system would remain the same. Therefore, this analysis, while significant to understanding the student's experience, does not attempt to tell the complete story of the class. Figure 1.0 details the activity system of the online class that Karen, Ann, Myriam and Jean participated in based on the student as the subject.

Figure 1.0


Tools = Web site, communications devices computer, electronic discussions
Subject = Student
Object = Comprehension of Course Materials
Outcome = Increased comprehension and internalization of course materials.
Rules = University policies, teacher policies and student norms.
Community = University, teacher, TA, and students
Division of Labor = University provides online system, teacher provides course materials and intellectual guidance, students complete assignments and engage in discussion.

Online education at Teachers College has existed for three years. The courses in which the students participated had very little history as online courses. In fact, both Karen and Ann were participating in courses that were given as an online course for the first time (Spring, 2001). Therefore, there is no direct online history for these particular activity systems; rather, the history is significantly linked to the traditional face-to-face classroom. The activity system for online education is quite similar to a traditional classroom activity system. The subject, object, community and outcome are the same for both. It is important to note that the historical experience of both the subject and the community in the online classroom is the face-to-face classroom. The expectations and actions of the members of the online classroom activity system have been conditioned by their experience in the traditional face-to-face classroom.

The offering of these courses online constitutes an expansion of the definition of the classroom activity system at the institutional level. A graduate level course at Teachers College is no longer necessarily geographically and temporally located. This expansion represents a historical shift at the institutional level with great consequences at the personal level. Engestrom (1999) discusses the significance of expansive cycles in the life of activity systems.

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> "'It is quite natural to endeavor to represent reproduction as *cycles* resulting in the formation of a new social structure on the basis of some preceding one' (Schedrovitskii, 1988, p.7; italics in the original). Such an irreversible time structure may be called an *expansive cycle* (Engestrom, 1987)...For the historical understanding of activity systems, expansive cycles are of crucial importance" (p. 33).

The new social structure emerging from the expansive cycle that has produced the online course is occurring at all levels of society, not just higher education. Castells (1994) defines this new social structure, "The control over knowledge and information decides who holds power in society. Technocrats are the new dominant class" (p. 41). Students capable of technically understanding the new classroom environment have an advantage over those who do not.

The expansion of the classroom activity system from face-to-face to virtual, coupled with the participant's historically based expectations combine to create the contradictions and tensions felt in the online class experience. Karen reported in the interview section that prior to coming to Teachers College she had very little experience with computers. "Before I came to Teachers College, I didn't even have e-mail and I didn't know what a web address was." Her expectation of the online class was that it would be similar to a "normal class." Karen's description of her learning experiences in the traditional face-to-face class was deeply grounded in the physical, geographic and temporal nature of that experience. The lack of these same features in the new system caused a great deal of distress for her and possibly impeded her intellectual growth. However, it is important to note that Karen found solutions to some of her problems through referring to the semiotic and concrete tool of the archived student discussions. This archive is a new feature of the activity system and it is a potentially rich source of learning within the new environment. The archive of the student discussion represents a new educational artifact that can be continually accessed and continually created. The externalization and dissemination of student thought is a significant innovation and an unparalleled educational tool integral to the new activity system which all of the participants took advantage of.

The design flaws that frustrated participants in the new activity system derive from the inexperience of the teachers in the new environment. In two of the courses, the teachers had never previously taught an online class and were not trained in the instructional design of educational technology. Therefore, errors in web-site architecture were made, including dating and labeling of material and the use of multiple URLs, which caused confusion for participants. The division of labor in the new activity system calls for technological knowledge and ability for all participants. Previously, content knowledge, administrative knowledge and a small amount of technological knowledge (word processor and copy machine functioning) were sufficient for efficacious teaching. In the new activity system we must add to this list the specific technological skills related to internet based communication (utilizing ftp, use of e-mail, web site architecture, understanding of hyper-linking, use of communications devices such as the discussion board and the chat room to name the most basic competencies); and teachers must give additional thought to design and layout of course materials and the facilitation of student participation.

The facilitation of student participation is related both to the division of labor and to rules in the new activity system. The rules for student participation revolved around posting to the discussion board. "I write something just so that I'm getting participation credit," lamented Karen. The new division of labor for the student includes not only the reading assignments and the essay assignments, but also weekly written participation in the discussion board. Karen continues, "sometimes in class [face-to-face] you don't always respond [to the discussion]...But I feel like in order to even know, for someone to know I was there, I need to [post to the discussion board]." This tension regarding the new rule of participation is a frustration for Karen, yet it is also a source of learning for her. Again we can note her use of the student discussion to scaffold learning and as a potential resource if one is writing a paper directly related to the topic of discussion.

Communicating with students requires attentiveness not only to the discourse on the discussion board, but also to individual e-mails sent to the Professor. Myriam's major disappointment in the online class was the lack of interaction with the teacher and the TA; "I send an e-mail and I don't know if they will answer or not, if they will reply or not and I regret that part." The new activity system requires a different type of time commitment from the teacher. Rather than holding office hours and a class each week, the teacher in the online environment must be ready to handle student questions and concerns at almost anytime. This is a daunting obstacle for the effective implementation of online education.

The degree of student agency afforded by the environment represents another shift in the division of labor and rule setting. In the new activity system, the community creates rules and norms through their actions. Therefore, the action of any individual within the community has authoritative potential. Those community members possessing the most facility and ease with the technological environment are potential rule makers and trendsetters in this environment. For instance, in Karen's class she noted that students seemed to post new comments to the discussion board on Sunday. So, she made a point of going to the discussion board on Monday to read the new posts. Additionally, Ann noted that in the chat room, any one of the participants could initiate a topic of discussion; it is not dependent on the Professor or the TA. While this level of agency may be good for the community as a whole, there is an inherent danger of alienation for the less technically proficient community members.

This danger of alienation has serious implications for the outcome of the new activity system, which in this case is the comprehension and internalization of course materials. This danger inheres for students not only from the potential of the empowerment/alienation dynamic brought about by the new configuration of rule making and division of labor, but also in the poor layout of the course materials, and the virtual nature of the tools. Karen expresses her alienation and her perception of its effect on the activity system outcome "...it feels really artificial and it feels like I'm...more concerned, like I said about, just what I write and being grammatically correct than like truly learning and getting new ideas and becoming a better teacher which was my whole goal of coming here." This negative assessment of the achievement of the intended outcome by Karen was counterbalanced in the interview by her admission that the experience had produced a meaningful unintended outcome for her as a teacher. She states that the experience has made her a more "empathetic teacher." Through her own reflection on the difficulties she had, she realized that different learning styles contribute to student success and satisfaction in a given classroom experience; she is bringing this new understanding back to her first grade classroom.

Discussion

The activity theoretical perspective has revealed both strengths and weaknesses of the new activity system. Many of the tensions Karen mentions can be relieved through specific adjustments to elements of the system. For instance, the inexperience of the Professors in teaching online that led to the design flaws could be addressed by the University through a training and orientation program for them. Likewise, orientation sessions for the students could attenuate the prevalence of historically based classroom expectations and facilitate the acquisition of technical knowledge that would situate each student as a potential leader in the class.

The lack of visual cues to aid in the encoding of information could be addressed by the use of web cams, video teleconferencing may also address this specific issue. The negative effects of the virtual nature of the course (the sense of isolation), could be addressed through the use of synchronous chats and collaborative assignments designed to facilitate student interaction. These adjustments could substantially reduce the frustrations that may impede learning in the online classroom.

Activity theory as a framework for understanding student behavior and experience in the online classroom is extremely useful. The complexity of Engestrom's model allows for a thorough view of factors influencing the subject. The emphasis on historical perspective situates the analysis meaningfully in a broader societal context. Indeed, participant reports of their online experience makes most sense in light of their historically based expectation of the traditional face-to-face classroom. The participants are not alone in the holding of this expectation. Society at large is undergoing an expansive cycle of revolutionary proportions regarding technological advances. We do not yet understand the full implications of these developments. Our expectations and prognostications are based on what has gone before. It is only through careful investigation of these emerging processes that we will be able to understand and direct their significance and impact. Activity theory is a useful framework for such an effort.

Implications of key findings

This study was designed to provide qualitative information about the experience of the student in the online course. The four main themes that emerged from the transcripts, web site design flaws, cognitive and coping strategies, the effects of virtuality and learning differences reveal important aspects of this experience. As designers and instructors, we need to pay attention to these aspects and use them as a roadmap to improving the educational experience of the online student. This can only be done if students are given clear expectations about the course format and course contents at the outset. For example, Karen's experience of 'having' to go back and re-read messages from previous weeks' themes could have been turned into a learning strategy by emphasizing that the online environment is not supposed to follow the same schedule as the campus course. That the lessons are never really "done" or "complete" in an online environment is a new concept, but it should be one that is exciting and valuable to the learner. Students should also be aware that they are in important part of the learning process; just as they might eventually depend on other students for guidance or feedback, so those students depend on them for the same reasons. Adjusting student expectations is the work of the instructor. Designers' efforts should focus on alleviating the negative effects of virtuality and in creating templates that directly support the instructor in developing clear layouts for the presentation and pacing of course materials.

Methodological considerations

Although we have many enlightening examples of how students behave in an online environment, due to the diversity of courses and web platforms used, it is possible that we were comparing apples with oranges. Therefore, the direct causal relationships—if there indeed were any—between inputs such as student disposition and course platform, and outputs in the form of student satisfaction and motivation to participate were unclear. Further research in this area might explore some of these causal relationships by selecting a more homogenous sample, such as students who participate in the same course, or students who are not currently taking on-campus courses.

Even if we were to repeat this study with a similar group of students, we would try to get more personal information from the students, such as their reasons for taking an online course, their reasons for coming to Teachers College, their aspirations and plans. Having additional information about their values and beliefs on and off campus would have provided us with more factors for analysis of their attitudes and behaviors online. Although most of the participants did compare some aspects of their behavior online to their behavior in class, it would have been interesting to compare their disposition in the online course with their typical disposition in class. Additionally, we might have asked these students what their expectations were before taking the online course and if these expectations changed at all.

This research project raised issues of importance in doing qualitative research based on non-traditional learning environments. For example, how does one observe someone's participation in a course, which typically takes place in isolation? Using the technique of videotaping and verbal protocol analysis may have been an adequate solution, but there is perhaps a better way that has yet to be discovered. Additionally, including in this way students who are located remotely would have been costly and impractical.

A final issue, that is not new to online learning, is how to actually measure learning outcomes. Karen, Ann, Jean, and Myriam all had unique learning experiences, and definitively more or less satisfying experiences, but did any one student actually learn more or less than the others? Did they perform more or less adequately? We can only hypothesize based on research experience with classroom learning techniques, but a more experimental, qualitative approach would have to be undertaken in order to say with certainty that different strategies or course design in the online environment really contributed to improved learning outcomes.

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Falling Behind: A Technology Crisis Facing Minority Students

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Abstract

The digital divide is a commonly used term in today's society, but few truly understand the impact that it has on minority students. This issue is one that goes beyond access to technology, but encompasses issues of equity in use. This article will examine the data on home and school computer use by minority students. It will also discuss the College Reach-Out Program (CROP) and the Community Technology Center at Jacob Riis Neighborhood Settlement House, which are two programs giving minority at-risk students non-traditional experiences with technology.

Introduction

In 1999, the Department of Commerce published a report entitled, *Falling through the Net: Defining the Digital Divide*, in which they found, "providing public access to the Internet gives certain groups the opportunity to advance by providing them with technical skills which are needed to compete in the digital economy." Those who have access to technology are being afforded more opportunities than ever before, but one must also think about what happens to those being left behind. There is a global discussion occurring surrounding the issue of the "haves and have-nots." Most research on the subject has uncovered what has come to be known as the "digital divide" or the separation between those who have access to and can effectively use technology and those who do and cannot.

This article will discuss how the digital divide affects minority students at home and school. Data from the Department of Commerce, Educational Testing Service, and other sources show that this population of students is not only the least likely to have access to computers at home, but also the least likely to gain access at school. I discuss one program, the College Reach-Out Program (CROP), which is working to overcome these inequities by exposing minority children to enriching computer activities. It is my opinion that alternative access opportunities must be created for these students, and I will review the work I did with a group of minority at-risk students and the educational program they were involved in. The project the students and I worked on gave them a different view of how computers fit into their present and future lives.

Home Computer Ownership

There are large disparities between the access opportunities of the rich vs. poor and ethnic majority vs. ethnic minority populations. The 2000 report, *Falling Through the Net: Toward Digital Inclusion*, from the U.S. Department of Commerce is the most recent data available on home computer ownership. It is evident that gains have been made across ethnic groups in acquiring home computers. As can be seen in Figure 1, all groups have

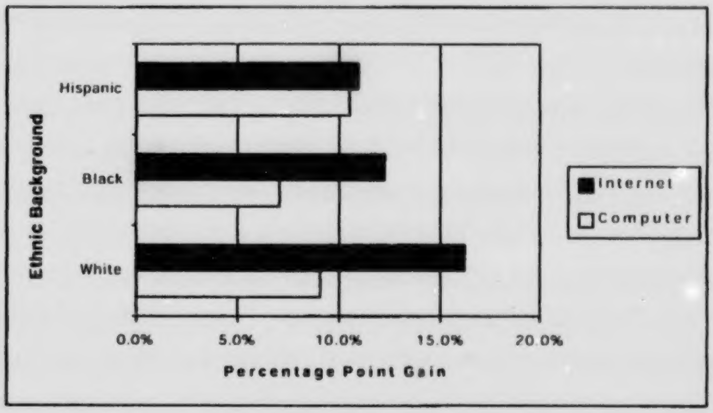

Figure 1, Gains in Computer Ownership and Internet Access, 1998-2000

experienced significant increases in home technology ownership. However, what is not immediately evident is how this growth has impacted the divide in access opportunities of different groups. The 1998 gaps between Whites and minority groups, with regard to computer ownership, still exist today. Between African Americans and Whites there was a 21.1 percentage point difference from in 1998 where there is a 23.1-point difference today. For Hispanics, the difference was 23.4 in 1998 and is 22.0 today. Therefore, even though all groups are increasing their technology acquisition, the differences in access rates have been maintained.

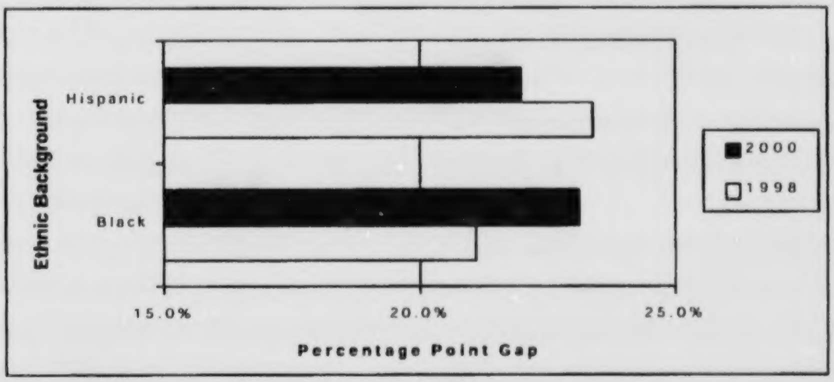

Figure 2. Change in home computer ownership gap, 1998-2000

It is not enough for a family to simply own a computer. Connection to the Internet is another confounding variable. Although, as with computer ownership, Internet access rates have increased, there are significantly fewer people who have access to the Internet than computers in the home. (Figure 3) This is not only true for the African American and Hispanic populations, but for Whites as well. Only 46.1% of Whites have Internet access, versus 55.7% that own a computer.

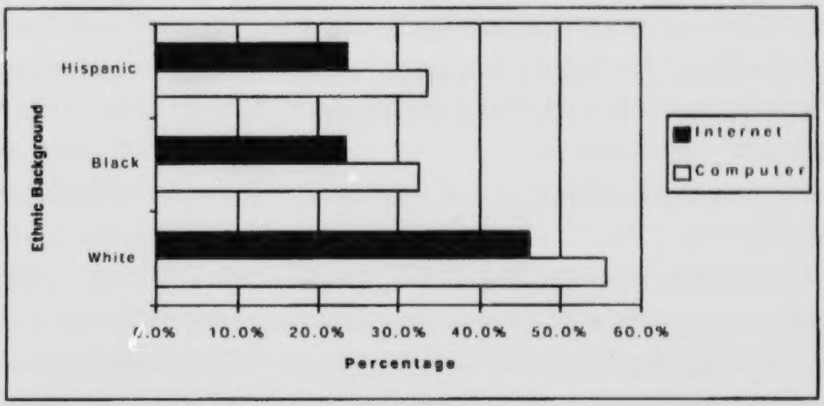

Figure 3. Computer Ownership and Internet Access, 2000

Unlike computer ownership, the gaps between Whites and minority groups regarding Internet access have not remained stable, but widened. In 1998 there was an 18.6 percentage point difference between African Americans and Whites in regard to Internet access. That difference has increased to 22.6 points. This increase has also occurred between Hispanics and Whites going from a 17.2 percentage point difference to a 22.5-point difference.

Technology Experiences at School

It should be apparent that there are extreme inequities in computer ownership and Internet access in the home. Yet, many people believe that creating access opportunities at schools, libraries, and other public areas will counteract these inequities. However, a look at the data on computer access in schools shows that inequities exist there as well. A 1999 report from the National Center for Education Statistics reported that in schools with a minority population greater than 50%, only 37% of the instructional rooms have computers. This is compared to 57% of instructional rooms in schools with a minority population less than 6%.

In addition, the Educational Testing Service found, that the more students a school has belonging to a minority or low socioeconomic group, the higher the ratio of students to computers, peaking at 32 to 1. This is more than 7 times the recommended ratio implying that poor minority students lacking access to computers at home are also not being given equitable access at school.

The inequities associated with students and technology do not end there. Let us suppose we are in a school that has overcome the last two inequities and has a good student to computer ratio for their students. Problems still exist. Even though they may be exposed to computers on a regular basis, the types of activities they are engaged in often times deal only with low-level thinking skills. The majority of the students from the CROP program reported to me that they used computers for drill and practice and practicing standardized tests. One student even said, when asked how she uses computers in schools, "We just do what the teacher tells us to do."

I do not believe this should be their only exposure to technology. In order for students to understand how computers fit into their daily and future lives they must see computers integrated into their education. One experience that greatly influenced my belief in using technology with minority at-risk students was working with CROP 2000. This program is detailed below.

The College Reach-Out Program

The College Reach-Out Program (CROP) is a collaborative effort of three Mid-Florida institutions of higher education—Central Florida Community College, Santa Fe Community College, and the University of Florida. The purposes of CROP are to identify and recruit economically and educationally disadvantaged students and help them move in a direction that could lead them to college. As can be seen in Figure 4, the majority of the students are African American.

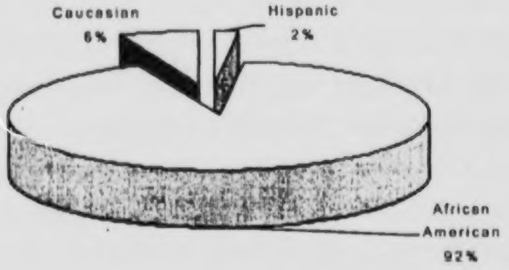

Figure 4, Ethnic Background of CROP Students

CROP is a program that functions throughout the year, but the summer is a special time for the students. Every summer, the rising 8th and 9th graders spend 5 days living on campus at the University of Florida. During that time they live in the dorms, eat in the cafeterias and interact with college students on a personal and academic level. Many current undergraduates work with the students as counselors, and are not only employed to handle disciplinary problems but to also give the students an opportunity to develop one-on-one relationships.

For their summer experience these students had the opportunity to create 1 1/2 minute movies using iMovie from Apple Computers (www.apple.com/imovie). The students were encouraged to make semi-autobiographical movies, but many chose to create a story instead. The only requirement was that they make something they could take pride in presenting. After the movies were completed, they were transferred to individual VHS tapes for the children to take home. I believe that a good way to understand how to structure new activities is to look at the triumphs and tragedies of those who have done it in the past. Therefore, below is a summary of the journal that I

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kept during the CROP 2000 summer program. I also include suggestions for those wanting to create their own design based on this idea.

CROP 2000 Technology Project

Although I was very excited about what we would be doing I wasn't sure if they would be as excited, but the second I told them they were going to be making movies I could see the excitement on their faces. The original plan for the students was for them to bring a bunch of pictures of themselves so that they could have a variety of images in the movie, but none of the kids brought pictures. It may be useful for those who want to use photographs in projects to have the students bring in the photos days before the project is scheduled to begin. This will avoid the problem of students not having pictures to use and having to spend time looking for images.

I talked to them about what the movies were going to be about and told them what the different roles (movie director, art director, musical director, and narrator) entailed. Once they picked their roles, I brought everyone back together in order to explain more in depth what they would be doing for the remainder of the day. Handouts were distributed to explain the roles, but as is true when teaching anything, it is best to orally communicate your ideas as well as putting them on paper.

At that time they were free to work for the remainder of the hour. Most of the groups spent time talking about what they were going to do because they wanted to be able to structure their pictures around a theme. I spent my time walking around and talking to the students, and from the questions they asked I it seemed that the hardest part for most groups was developing a theme. It was refreshing to teach a computer class where the hardest part for the students was not using the computers. It became a tool for accomplishing a task instead of the task itself.

I was naïve about how smoothly the project would go and it slapped me in the face on the second day. They came with just as much energy as on the first day but seemed to get more hyperactive as the morning went on.

Since, as I mentioned before, they did not bring any photographs, they were to spend 10 minutes looking up pictures on the Internet of someone they admire. A problem, however, was that they did not know how to search the Internet. Considering that the majority of these students reported owning a home computer (71%) and using the Internet at school (55%) they did not know how to search the Internet. Instead there was a lot of "I can't find anything", and "Where can I find pictures?" Most teachers will not be working with students that they have never seen before, so they can more easily gauge student expertise. However, for those working with new students, I would suggest assuming they don't know anything. That way, if they do have knowledge coming in, it will only enhance the project as opposed to hindering it.

The last day was crunch time. Instead of allowing the kids to come into the computer lab as I usually did, I met them outside to give explicit instructions for what they needed to work on, but even with these instructions all of the groups stayed an extra hour to finish their work. After they finished, we watched the videos and they were all very proud of what they had accomplished.

Student Feedback

As can be seen above, the program was not easy to organize and implement. Nevertheless, what I hope you get from this is that it can be done, and is something students will enjoy. I asked the students to write comments about their experiences working on this project. Some of the comments I received were:

- "I never knew how fun it could be making a movie on the computer."
- "It can be kind of hard, but when you put your mind into it you can do it."
- "I didn't know you could take pictures and put them on the computer."
- "I got to look at things on the computer that I usually don't look at."
- "I didn't know there was so much excitement."

These types of responses cannot be elicited when students are engaged in technology use that merely reduces them to passive clickers.

Jacob Riis Neighborhood Settlement House

Community Technology Centers are one of the ways that communities nationwide are working to bridge the digital divide. These centers allow residents of communities to have access to technology as well as take classes to improve their technical skills. This community center is located in the Queensbridge Public Houses, home to 12,000 residents, 5000 of which are under the age of 18. The Community Technology Center within offers programming for all residents of the community ranging from an after-school program to evening adult classes. My current position is as the Community Technology Center coordinator for the Jacob Riis Neighborhood Settlement House. In that position, I am responsible for developing, staffing, and scheduling all technology programs offered at Jacob Riis. One exciting program that works with children is the Our kids After-School Program.

The Our kids program is designed for students ranging in age from 5 to 10. All participants come to a technology class twice per week where they are engaged in alternative technology experiences. After-school programs are a great place to try innovative and exciting technology projects, and one project we are trying with our students uses the program Microworlds. Microworlds is an application that was developed to teach young children programming concepts in a fun and exciting way. The interface for Microworlds is kid-friendly and allows children to not only program but also draw and create imaginative projects as well.

One example of such a project is an autobiography. Our students are creating an interactive program in Microworlds that will tell their stories. In contrast to a traditional autobiography that would solely be made up of writing, our students are drawing pictures and weaving those pictures into their stories. This allows them to develop their literacy, technical, and creative skills in one setting that is fun.

Implications and Suggestions

From reading the information that has been published about the digital divide and from my experiences with the CROP program and Jacob Riis, it has become abundantly clear that we are entering a time in our society where there is a new type of inequality. Computers give people access to more information than at any other time in our history. However, a large part of the population is being left behind.

No matter how you look at the data, poor and minority students are at a disadvantage concerning access to new technologies. The argument I have heard many times is that we cannot expect families who are struggling to survive to be able to afford a computer. However, what we should be more concerned with is how to engage these families through the use of technology.

We also must think about how we are using technology with minority students. When I met the CROP students, I discussed some of the things they were using computers for at school. The responses I received were quite disheartening. The majority of these students stated that they used the computer to play games or take tests. Their home use was not helping them to excel either. Most of the students in the CROP program own computers (95%), but none of them knew how to search for pictures on the Internet. Students who do not have access to high-quality computer experiences at home or school are not being provided with the opportunities they need to be successful in society. Is this the way we want to prepare students for the future?

This issue is far from being solved. There are many factors that must be taken into consideration when discussing the impact of a new technology on society, and computers are not any different. There are always those for whom it is a benefit and those for whom it is a detriment. The first step in bridging the gap is to realize that technology has not benefited everyone equally, and begin to work on ways to level the playing field. One possible solution is to expose students to innovative projects, such as the ones for the CROP program and Jacob Riis, which allow them to expand their views about how computers fit into their lives now and in the future.

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Lessons Learned from a University Partnership Established to Promote the Adoption of Educational Technology: One Size Does Not Fit All

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Introduction

The accessibility and affordability of the computer and the rapid expansion of the Internet, has put information literally at our fingertips. We are now able to procure volumes of data with just the stroke of a key. The field of technology is rapidly accelerating to allow for commonplace interactive audio, video and computer conferencing. Possibilities for communicating and exchanging information seem limited only by our imaginations.

Therefore, in order to prepare students for this swiftly changing Age of Information, the use of technology in education should become a critical factor. It is no longer enough that instruction flows from teacher to student, nor will it be enough to only expose students to technology; students must learn to become active participants in the process of their education. We need to recognize that social, political and economic changes are occurring and forcing our society to offer alternatives to traditional education. Research over the past 25 years has shown that interaction involving a purposeful cognitive approach by the student is an essential component in the learning process. Therefore, education courses need to encourage students to be self-reflective, self-corrective and self-constructive learners. Specifically, technology in education, with its "instant" availability, but more importantly, with its ability to allow learner control, is a viable solution to this need.

Background Information

The nature of the Information/Communication Age in which we live demands that we prepare the students of today for the challenges of tomorrow. Change is occurring faster everyday and students and society are left economically and socially at risk (Lane & Cassidy, 1997). As a result, students will need to not only be prepared, but empowered. In order to increase global awareness, keep pace with and implement the rapidly changing technology, and adapt to the changes in the work force, schools need to adjust to meet these demands.

Traditionally, the teacher has been at the heart of the educational system as the deliverer of knowledge and the center of learning. However, with the onslaught of available information, teachers are no longer able to know everything of value to teach students, but are now learners along with their students. No longer isolated work units within a classroom, the teacher of today needs to facilitate the learning of the students and empower them to explore and learn by accessing the additional expert resources in the community and throughout the world (Guerra & Alvarez-Buylla, 1995). Methods and strategies involved in facilitating this process need to include guided practice, inquiry learning, and teamwork. Interaction must be a part of the learning process; however, the teacher may or may not be physically present.

Since educational technology, when properly used, forces the role of the teacher to shift, it is a natural conclusion that the role of the student must also change. For example, research shows that learners presently enrolled in distance education courses are more likely to be active listeners and are able to work independently (Trier, 1996). While motivation is a key factor, it can be increased if students feel that there is a certain relevance to the medium and the message and if they are given the opportunity to create a meaningful project from the material covered. Students will be given more initiative and have more control over what they learn. Behaviors expected of students will include being self-directed, responsible, and proactive.

In their research, Roblyer, Edwards and Havriluk (1997) note that students realize several unforeseen benefits. Slower students blossomed, less popular students were sought out for advice and assistance, and formerly unmotivated students became excited and involved. Teachers of these students observed improvements in student academic performance, self-esteem, and increased acceptance of responsibility (Roblyer, Edwards & Havriluk, 1997).

However, when any classroom is transformed because of the appropriate use of technology, it is to be expected that students need an adjustment period. Changes in the approaches to teaching and to learning will result in cognitive dissonance. Students will no longer be able to expect traditional behaviors from teachers, while simultaneously, they are readjusting to their new responsibilities.

Further, the role of the school will have to shift in order to more accurately reflect the work environment. Work environments, and the world in general, are increasingly becoming global in their operations. Contemporary society is faced not only with the problem of promoting the expansion of knowledge, but also of generating a workforce which is capable of adjusting to the Information Age. Students will need to learn more effectively and efficiently than ever before because of the rapid growth of information and because of the escalation of knowledge and skill requirements for most jobs (Wellburn, 1996).

The Contributions of Technology to Education

Before technology will be adopted into the educational process, teachers must first be convinced that there is some advantage to using technology. Findings from the Apple Classrooms of Tomorrow (ACOT) research suggest that students' behaviors and attendance improved, along with attitude toward themselves and toward learning (Ringstaff, Yocam, & Marsh, 1996). Improved student performance was also noted in several ways: (1) test scores indicated that, despite time spent learning to use technology, students were performing well, and some were clearly performing better, (2) the students wrote more, more effectively, and with greater fluidity, and (3) some classes finished whole units of study far more quickly than in past years (Ringstaff, et al, 1996). Other unintended outcomes were noted which included students becoming socially more aware and more confident, students working well collaboratively, and students exploring and representing information dynamically and in many forms (Ringstaff, et al, 1996).

Educational technology makes it possible to create learning situations in which students can be engaged in activities that they find interesting and exciting for their own reasons and which accomplish the educational goals of teachers (Riel, 1989). Teachers can plan various activities simultaneously, and students can learn in an interactive, workshop-style format (Piper, 2000). Computers give teachers the opportunity to expand the boundaries of the classroom (Facemyer & Peterson, 1996, as cited in Piper, 2000) by allowing instant access to information and specialized expertise. In addition, educational technology can create new avenues for social exchange and cooperative learning (Riel, 1989).

Barriers to Change

There are many factors responsible for the non-adoption of educational technology among teachers. The National Center for Education Statistics (NCES, 2000) reports that in 1999, one of the barriers most frequently reported by public school teachers was the lack of computers. If teachers are expected to use computers in the classroom, it is only logical to assume that computers will be provided. However, access alone doesn't ensure adoption of technology. Location, access, and current, compatible software play a part in determining how they will be used (Sheingold, 1991). Moreover, teachers at schools with minority students accounting for more than 50 per cent of enrollment were more likely to cite outdated, unreliable, or incompatible computers as barriers to use (NCES, 2000).

Even if the problem of access is solved, teachers must still be taught to help their students effectively use Internet resources for learning purposes. Evaluating web-based resources is an essential skill because the Internet, besides hosting a wealth of valuable educational resources, is also the single largest source of misinformation in our society (Maney, 1999).

Another barrier reported frequently by public school teachers was the lack of release time for teachers to learn how to use computers or the Internet (NCES, 2000). Franklin (1999) reports that time was the most often recorded item on the list of barriers that remain in place to prevent technology adoption. She further states that "this coincides with the President's Committee of Advisors on Science and Technology, which found teachers did not have enough time in the day to develop new lesson plans for the implementation of technology when technology was newly placed in a school" (Franklin, 1999). Chiero's (1997) study on *Teachers' Perceptions On Factors Affecting Computer Use* lists lack of time as the single most important barrier to technology adoption. Teachers must be allowed adequate time to learn new technologies (Maney, 1999). A lack of time constrains teachers from thinking about new ways of organizing learning in their classrooms by the need to handle day-to-day issues, surprises, crises and challenges (Fullan, 1999). Among other things, this daily press for time makes teachers dependent upon what they already know and prone to following routines (McKenzie, 1999).

An additional barrier reported by teachers is lack of time in the schedule for students to use computers in class (NCES, 2000). Traditional 40 or 50-minute class periods do not allow sufficient time for students to be engaged in learning through use of technology.

If teachers are going to adopt and use technology, there must be a support infrastructure available to help them troubleshoot and solve technology-related problems (Maney, 1999). This includes administrative support, technical support or advice, and support regarding ways to integrate telecommunications into the curriculum (NCES, 2000).

Other barriers to technology use as reported by the National Center on Education and Statistics (2000) from teachers' survey responses included concern about student access to inappropriate materials and inadequate training opportunities. Chiero's (1997) research confirmed that lack of adequate training is a resource frequently mentioned as a major barrier to computer use. Lack of training was the second most often reported barrier in the study done by Franklin (1999). The need for professional development continues to be a concern for public schools.

The Adoption Process

The adoption of technology with instruction presents a challenge to those involved in the change business. Fullan (1999) describes the process of change as being complex, dynamic, and unpredictable. Senge (1990) defines the building process as the capacity to hold a shared common picture of the future we try to build or seek to create A successful change agent must be comfortable dealing with ambiguities and with failure while remaining focused on the goal.

"Situated" Change: Failure often occurs because reform is often packaged as a "one size fits all" deal. Miller (1996) defines a situated notion of school reform as a reform that "conceptualizes restructuring of pedagogies, curricula, and school organizations as changing in purpose and form across differing educational settings and circumstances" (Miller, 1996). She stresses that the difficulties and divisiveness that often arise occur because reform efforts are generalized to all settings, rather than situated to specific setting.

In order to allow change to be situated, the process of adoption should first begin with the knowledge stage, as Rogers (1995) calls the initial stage of the adoption process. Crucial information needs to be communicated by the change agent to the educational system. Specifically, those in this field need to be aware that the use of technology in education is more than just a technological system or a tool. Instructional technology allows for its innovative capabilities to interact with the creative talents of its participants (Chute, Thompson & Starin, 1996). This information must be successfully disseminated to the users by the change agent if the goal of integration can occur. The challenge of integrating technology into schools and classrooms is really much more human than it is technological (U.S. Office of Technology Assessment, 1995).

Educators must clearly understand that technology changes the context in which education takes place (Lane & Cassidy, 1997). Teacher roles, student roles, school structures, and related issues all need to be defined prior to implementation. However, in order for any school reform to be successful, a goal is necessary, and because of the nature of the school, that goal needs to be directly related to observable student performance. It is important to remember, however, that while the objective of change is the same, the process will be different for each situation.

Developing a Vision: The next step toward adopting educational technology is developing a vision of how technology should influence what educators do (Costello, 1999). The educational staff must contribute to the vision. A team approach creates ownership, which in turn will promote future implementation of the plan. Ownership of the process of change is a powerful motivational strategy.

The key to effective adoption is continued dialogue throughout the process and as newer technologies become available. The premise that we are lifelong learners is a fundamental principle of distance education. Educators need to realistically evaluate the educational system with this in mind. While creating the vision is the second step, the way in which to continually promote change and growth is by maintaining and allowing for modification of the vision.

Wellburn (1996) states that schools which spend time creating an instructional vision based on instructional goals and a shared philosophy have been most successful in adopting educational technology. His findings illustrate Rogers (1995) authoritative type of Innovation-Decisions. First, Wellburn (1996) supports the fact that those in authority need to make the decision to adopt the innovation. Once the decision has been made, those whom it affects are then given the authority to determine how best to implement.

Staff Development: In order for the educational system to survive, it must maintain a competitive edge (Senge, 1990). Historically as well as presently, our schools have been slow in their ability to learn and to adjust to change. The evidence is seen in the rapid acceleration of the computer industry and the relatively slow rate of adoption of its technologies into the classroom

Teachers need training and they need to be involved in the integration process. When adults see themselves as the locus of causality for their learning, they are much more likely to be intrinsically and positively motivated to change (Wlodkowski, 1993).

According to McKenzie (1998) and the U.S. Office of Technology Assessment (1995), technology training is most effective if presented to teachers in a "just in time" fashion. Teachers will learn as they need to know. Moreover, Gilmore (1995) stresses that staff development should take place in the school. An advantage to this arrangement is that learning occurs in the natural environment. Teachers will be trained with the actual hardware and software that they are expected to use.

In addition, learning along with one's peers creates a cooperative atmosphere. This promotes more exchange of information, more helping and sharing of resources among members, more peer influence toward productivity, higher incidence of creative and risk-taking thinking, higher emotional involvement in and commitment to productivity by more members, higher acceptance and support among members, more of a problem-solving orientation to conflict management, and a lower fear of failure by members (Wlodkowski, 1993). Change will occur most quickly in environments where innovation and collegial sharing are operating simultaneously, each promoting the other (Sandholtz, Ringstaff & Dwyer, 1997).

Certain factors are needed to promote the change. Specifically, due to the perceived complexity of the any technology, an agent should identify needs and provide for leadership and support for the innovation with the teachers expected to adopt (Hutton, 1994). The change agent should also encourage partnerships to develop which would foster the adoption. This process involves identifying the categories of adopters, which in this case would be identifying those with varying degrees of computer experience.

Technical Needs: McKenzie (1998) emphatically states that relying on only a few technology specialists and risking the development of dependency relationships might actually delay the progress toward technology integration. In order to utilize technology effectively, teachers need immediate assistance when equipment fails. Unresolved hardware and software problems will create frustration, and if not dealt with immediately, teachers will abandon the attempt to use the technology.

If, in fact, effective technology use does enhance student learning, then rapid and appropriate incorporation of technology is essential. In a 1995 report, the U.S. Office of Technology Assessment (OTA) asserts that helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized. Sheingold believes that properly trained teachers make the difference between the success or failure of an integration effort (as cited in Roblyer, Edwards, & Havriluk, 1997).

Summary

The appropriate use of technology in education is one viable solution to the challenge of training students for this Age of Information. Relatively few schools offer such a program at present. Research, although still sparse, has indicated that student achievement is comparable to traditional student achievement.

Benefits and barriers have been presented. The most logical benefits are improved student performance, behavior and an efficient manner of procuring information. An additional benefit which needs to be mentioned is the global awareness and education it easily provides for learners.

In addition to barriers referred to previously, logistics present major difficulties. Administrators and staff would need to thoroughly and elaborately organize and prepare for the implementation of technology in the classroom. Many hours would need to be dedicated to studying proper implement procedures. Hardware and software would need to be bought and installed. Space is a consideration. An ongoing needs assessment would be necessary once a program is in place. Technical support throughout would be critical to its survival.

In spite of these potential limitations, educational technology can work effectively with our school systems to properly equip our students for the future. The educational system has to be willing to change and adapt in order to not only survive, but to empower its learners to be proactive participants in this rapidly shifting world.

Experts in the use of instructional technology have suggested that there are four factors necessary to facilitate the adoption of technology. First, the process of change needs to be situated to each particular school. Second, establishing a goal is critical. Third is the necessity of staff development. Finally, technical support must be provided.

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Moving Beyond the Training Environment to a Vision of Technology Integration in the Classroom Curriculum: Implications for Practice

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Abstract

Most teachers have little experience integrating technology into their students' learning processes and typically do not have models on which to build their own visions of an integrated classroom (Beichner, 1993; Cifuentes, 2001; Kerr, 1996; Schrum, 1999; Studler & Wetzel, 1999). Teachers participating in technology training must move beyond training classrooms to apply teaching methods that facilitate technology integration in their classrooms.

The purpose of this study was to determine to what extent teachers (a) alter their teaching methods and (b) integrate technology into their classroom curriculum during, and after a technology training course designed to prepare teachers to use technologies that support their teaching and student learning.

The eight cases studied illuminated the processes of technology integration for elementary and secondary teachers possessing low and high levels of technology skill and use. Through the results of this study, instructors will understand better how to facilitate training in the integration of technology for different types of teachers. The study identified implications for future studies involving technology integration training and processes of integrating technology in the curriculum.

Theoretical Framework

In order to investigate the processes that occur during and after technology training as individuals integrate technology into their classroom curriculum, an understanding of the current educational system as it relates to technology and teaching practices must be established. The goals of restructuring the current educational system were reviewed to gain understanding of the shift from the traditional role of teachers as purveyors of knowledge to a role that allowed for the establishment of a more learner-centered environment and the role that technology would have in establishing these new roles and supporting the new learning environments (Goals 2000, 2000; Technology Assessment [OTA], 1995; Texas Long Range Plan, 1996). The theoretical foundations of this study are therefore based on a conceptual understanding of: (a) the goals of restructuring; (b) the role of technology in restructuring; (c) the changing roles of teachers; (d) teacher training; (e) barriers to technology integration; and (f) the implementation process.

Training teachers in the processes of integrating technology must replace current practice of simply training teachers in computer applications (Brownell, 1992; Ertmer, 1999; Roblyer, Edwards, & Havriluk, 2000; Schrum, 1999; Simonson & Thompson, 1997). Teachers determine what happens in the classroom and how innovations are or are not implemented (Sandholtz, Ringstaff, & Dwyer, 1997). Therefore, if teachers are to move beyond the training environment to implementation in their classroom, they must be prepared to overcome obstacles that interfere with the process. Effective training programs are needed to provide teachers with models to build their own visions of an integrated classroom (Beichner, 1993; Cifuentes, 2001; Kerr, 1996; Schrum, 1999; Studler & Wetzel, 1999).

Methods

Case study methods (Wiersma, 1995) were applied to gain an understanding of the experiences of teachers as they moved through an OL or F2F course designed to prepare teachers for integrating technology into the curriculum. Complementary data collection processes (Shulman, 1986) were used in each of the eight cases to provide depth and breadth in identifying and analyzing the barriers and processes affecting the impact of the training course. In this study, the integration of survey, interview, and observational approaches offered the researcher an opportunity to develop a complete analysis of participant behavior from a holistic perspective (Gall, Borg & Gall, 1996).

Data Sources

INST 6031: Applications of Technology, a core graduate-level course offered by the School of Education at the University of Houston – Clear Lake, introduced students to the tools and skills necessary to understand and operate computers, navigate the Internet and World Wide Web, and create hypermedia products. The course included educational applications of instructional and information technologies to promote the integration of technology into the curriculum. Emphasis was on the comprehensive integration and implementation of the Technology Applications Texas Essential Knowledge and Skills (Texas Education Agency, 2001), Secretary's Commission on Achieving Necessary Skills (SCANS) 2000 report (U.S. Department of Labor), and those tools that have important implications for the creation of products with the technology. The course was offered either in an OL format or in a traditional F2F setting. Within both delivery methods, a combination of hands-on lab assignments and content material was offered through a student-centered approach.

The PK-12 teachers enrolled in all sections of the graduate level *INST 6031: Applications of Technology* course at University of Houston – Clear Lake made up the pool of 30 participants. A computer use survey was administered and collected prior to any classroom instruction. The survey scores were based on a point value associated with the level of skills selected by the individual, levels 1 - 4 were given point values of 1 - 4 accordingly, no response resulted in zero points for that question. The participants were divided into two groups, which were representative of the participants' teaching grade levels Elementary (PK-6) and Secondary (6-12). The Elementary and Secondary groups were then divided by course delivery method. The two course delivery methods under investigation were OL and F2F. Therefore, the cases for investigation were selected from a sample of Elementary – OL, Elementary – F2F, Secondary – OL and Secondary – F2F. A systematic sample using circular lists, rank ordered by skill level from highest to lowest composite score, was used to ensure representation of varied technology skill levels within the grade levels.

Results

Initial attempts at integrating technology indicated all of the teachers used technology in ways that replicated their current teaching practices, which meant six of the eight participants created teacher-directed technology-based lessons. Those who developed learner-centered integrated lessons followed more constructivist principles in the classroom. Their classrooms were learner-centered environments that focused on discover and problem solving.

During the final observation all teachers used technology tools that were learner-directed in application, although many of the activities still perpetuated the teacher-directed environment. Those who had consistently used constructivist principles in their teaching continued to develop learner-centered activities that incorporated technology.

During Web-based activities students were responsible for obtaining, synthesizing, and reporting on information obtained from the Internet. In the three classrooms that used a Web-based activity during the final observation, student engagement increased, discipline problems declined, and the teachers' role changed from the sole provider of knowledge and skills to one of facilitator or guide.

The researcher found several intrinsic and extrinsic factors that affected the integration of technology. Lack of technical support was consistent on seven of the eight campuses. The campus with onsite support personnel who assisted the teacher in locating resources, preparing the computer for student use, and assisting during the technology-based lesson, moved to a higher level of collaboration among the teachers on campus than the other observed campuses. Additional barriers beyond the control of the teachers or the researcher were created by (a) an emphasis on a fixed curriculum that supported TAAS and End of Course objectives, (b) a lack of technology training, and (c) insufficient resources.

Teachers' use of technology was directly impacted by district and campus level policies. The teacher in the one-computer classroom was hindered by policy that restricted use of the computer to the teacher only. The restricted use affected the ability of the teacher to move beyond teacher-directed instructional uses of the computer. This was especially true of Internet access, which mandated that all Internet-based activities conducted in the classroom had to be directed by the teacher at all times.

There were no noted differences between the growth in skill levels of the teachers involved in the OL section of the course and those in the F2F section. There were differences between the OL section and the F2F section in their identified Stages of Concern. Only the F2F section teachers indicated increased concerns about collaboration (Stage 5). Only the OL section teachers indicated increased concerns about modifications or alternatives to technology integration.

When comparing across the two groups, the level of use was a greater among those teachers enrolled in the F2F section of the course than those enrolled in the OL section. This could indicate that the F2F population benefited from the ability to see and interact with technology integration in an environment that closely resembled their own classroom settings.

The teachers in the F2F section used cooperative groups and demonstrations more frequently than the teachers enrolled in the OL section. This is consistent with research on the influence past learning experiences have on current teaching practices because the F2F group had increased opportunity for cooperative group work and the OL section relied on demonstrations for a large percentage of their content materials (Dwyer, Ringstaff, & Sandholtz, 1990a, 1990b). Classroom management for the F2F and OL section teachers was consistent with that of the other groups. Both groups indicated improvements in classroom management with the use of technology.

Elementary and Secondary teachers varied in their growth in skills and knowledge of basic and advanced computer use but were similar in those related to Internet use. The two groups were similar in their identified Stages of Concern. Both groups focused early on informational (Stage 1) and personal (Stage 2) concerns. The majority of teachers in each group indicated increased levels of concern over time for the consequences of using technology with their students (Stage 4). The Secondary group contained a higher percentage of teachers with time, logistics, and management concerns (Stage 3).

The levels of use of the teachers in the Elementary group increased by a higher margin than that found in the Secondary group.

Initially the two groups varied in their preferred methods of instructional delivery. By the end of the semester the two groups were closely aligned in their uses of instructional methods.

The teachers in both groups indicated improvements in classroom management with the use of technology, citing increased student engagement with technology. The need for discipline was reduced in both groups. Student assessment was more manageable when the students were interacting with the technology.

There were not dramatic differences in initial skill levels between the High Skill and Low Skill level groups. The biggest difference in the initial scores was in Teacher Internet Use (Part C). While both groups focused early on informational (Stage 1) and personal (Stage 2) concerns, only the Low Skill level teachers indicated increased levels of concern over time for the consequences of using technology with their students (Stage 4). Both groups indicated increased concerns about collaboration (Stage 5). Both groups indicated low levels of concern related to time, logistics, and management concerns (Stage 3).

When compared across the two groups of teachers, it appears that the Level of Use was most impacted by initial Level of Use and increased skill levels over time. Teachers at the Low Skill level encountered higher levels of technical difficulties that required assistance from the researcher to resolve. The lack of onsite assistance directly impacted their ability to use technology without additional support.

The High Skill teachers indicated they used a wider variety of instructional methods on a regular basis. After training the two groups were more closely aligned with the Low Skill teachers now indicating increased frequency of a wider variety of methods. Indicating that as skills and knowledge increase the individuals' choice of instructional methods were expanded.

In summary, the results of this study indicate that the individual characteristics of the teachers, the content area they teach, their previous teaching experience, their career goals, and their classroom environment have an impact on how and to what degree they integrate technology into their classroom curriculum during and after training in the processes of technology integration. A course designed to train teachers in technology skills and technology integration raises the skill levels of the teachers, increases the use of technology in the classroom but the course in this study did not alter the teachers' established teaching methods. This researcher hypothesizes that such alterations require a more comprehensive effort than one class.

Discussion

The teachers in this study possessed unique sets of skills and knowledge related to computer use, Internet use and technology integration. Concerns were individualized and personal, often directly linked to their campus environment, their previous educational training, their prior teaching experience, and their career goals. Levels of use reflected skill and knowledge growth as well as the access and availability of technology within the school environment. Instructional methods were used that met the needs of content, students, and personal preference. Classrooms were managed in ways that modeled the classrooms of the individuals' past educational experiences.

During the course, the teachers obtained instruction in basic use and technology integration. However, their skill growth did not reflect the amount of training received but instead reflected the individuals' initial skill levels and opportunities to reinforce the new knowledge through practice and application. Therefore, teacher preparation programs need to integrate technology throughout the program and not restrict technology instruction to one course; one course is not enough.

I observed uses of technology in the classroom that replicated the activities in the course and sought to mimic the existing teaching practices of the individual teacher. The teachers who adhered to teacher-directed principles were unable to create a vision for technology integration in their classrooms, while those who followed a more constructivist approach to instructional delivery were able to envision technology as a tool that would enhance the teaching and learning process.

Teachers need more experiences with technical skills and knowledge if they are to develop a vision for technology integration within their own individualized environment. They need models of effective teaching practices that integrate technology. They need access to resources that promote or support technology integration in the curriculum. They need to experience technology integration in environments that closely resemble their own classrooms; and they need opportunities to practice technology integration in their classrooms with the necessary levels of technical and administrative support.

If teacher educators are to facilitate technology integration for different types of teachers, they need to design and implement learning environments that (a) are learner-centered, (b) encourage collaboration, (c) promote discovery, and (d) provide activities that are engaging and relevant to the individual needs and environments of the learners. Teachers will develop visions of technology integration based on their own educational experiences. Therefore training programs must provide rich extended experiences in technology integration and model effective practices and innovative uses of technology that improve teaching and learning.

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The evidence for InTech: What does research say about Georgia's required technology training?

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In 2000, the Georgia Legislature mandated that all certified school personnel complete the Georgia Framework for INtegrating TECHnology in the Student-Centered Classroom (InTech) or approved alternatives. InTech is a constructivist-based technology-training program. It was developed as a statewide staff development initiative by the Georgia Department of Education in 1997, and was implemented in 1998. The purpose of this paper is to provide information about this initiative to improve teaching and learning through technology. Included are a problem statement, brief summaries of three dissertation research studies investigating the influences of InTech, and recommendations regarding similar initiatives.

Statement of the Problem

Since 1993, the state of Georgia has invested over $337 million in support of its belief that providing educational technology for classrooms offers effective ways to improve schools and to help students learn (Brackett, Henry, & Weathersby, 1999). It has been reported that Georgia schools have 210,885 computers, with 98 percent having Internet access and 49 percent equipped with local area networks (Coley et al, 1997; Georgia Department of Education, 2000). The FY 2001 Georgia education budget included $29,485,875 funding for computers (Sherrod, 2000).

Availability of technology is one issue; its use is another (Byrom, 1998). To prepare teachers to integrate technology, student learning, and academic goals, the Georgia Framework for INtegrating TECHnology in the Student-Centered Classroom (InTech) was designed as staff development training in technology. Its overall goal was to provide a catalyst for fundamental changes in the teaching and learning process. Instruction in this program is constructivist-based and is expected to lead participants to development of constructivist teaching philosophies, characterized by a shift to more student-centered learning (Holmes et al., 1998). InTech activities are designed to promote active, problem-based learning opportunities that can be transferred to participants' classrooms.

Since its introduction in 1998, numerous Georgia school systems voluntarily have implemented InTech and over 15,000 Georgia educators have been trained through the program. In 2000, Governor Roy Barnes signed into law Georgia House Bill 1187 (The A Plus Education Reform Act of 2000) which mandates that all Georgia teachers and administrators seeking certification or certificate renewal must complete successfully the InTech training program or demonstrate competency in ISTE computer skill standards through alternatives approved by Georgia's Professional Standards Commission.

This state-sponsored initiative was enacted to improve Georgia's schools and to enhance student learning; however, decisions for the ongoing commitment were made without empirical support. To address the specific need for research examining the influences of InTech and the general need for research examining the most effective ways to implement changes necessary for integrating technology into the curriculum, three doctoral candidates at Valdosta State University (VSU) conducted dissertation studies of InTech. Variables of the three studies include: perceived levels of technology integration, accessibility to technology, administrative support, teacher integration of technology, student utilization of technology, teacher and administrator beliefs related to technology use. Summaries are given below.

InTech Training, Technology Integration, and Administrative Support of Technology: Perceptions of Elementary School Teachers.

By Lynn Minor

InTech has been offered to teachers in the Valdosta State University (VSU) service region for the past three years through the VSU Educational Technology Teaching Center (ETTC). However, the extent to which InTech training at the VSU ETTC or through the redelivery program affects the technology integration of teachers was largely unknown. Redelivery is a term used to refer to a model of implementing InTech training in which teachers receive trainer-of-trainers instruction at the ETTC and return to implement InTech with teachers in their own school. This quantitative research study was conducted to evaluate the effectiveness of Phase One of the Elementary InTech Professional Development Program offered at Valdosta State University. The purpose of the investigation was to examine perceived levels of technology integration of elementary school teachers as a function of the InTech training model received and to determine whether a relationship was present between perceived levels of administrative support and technology integration. Accessibility to technology in the classrooms of the participants was also investigated.

Methods

Data for this study were collected using a questionnaire, titled Technology Integration Survey for Teachers, that was adapted from the Student Achievement Survey used by the Bernie School District (1999). Twenty-six questions concerning teachers' perceptions of technology use in their classrooms, accessibility of technology in the classroom, and administrative support for technology integration in their schools were included on the instrument. Participants were selected using purposive sampling to include teachers in the Valdosta State University (VSU) Educational Technology Training Center (ETTC) service area who teach at elementary schools with the following three groups of teachers: teachers who received InTech training at the VSU ETTC, teachers who received InTech training through the redelivery model at their own school, and teachers who have not received InTech training. Twenty-six elementary schools, representing 9 of the 45 school districts in the VSU ETTC service area, met the criteria for this study. Completed surveys were received from 630 of the 993 possible participants, representing a response rate of 63%.

Results

Responses to sixteen Likert-type survey items were combined to calculate the perceived level of technology integration. A one-way analysis of variance (ANOVA) was conducted to determine whether an overall difference in the perceived level of technology integration was present as a function of the InTech training model. Statistically significant differences were found for perceived levels of technology integration with a main effect of $\underline{F}$ (2, 610) = 66.28, $\underline{p} < .0005$. Teachers who received training at the VSU ETTC ($\underline{M} = 50.69$) perceived their level of integration as significantly higher than did teachers who received training through the redelivery model ($\underline{M} = 46.15$) and teachers with no InTech training ($\underline{M} = 37.41$). Furthermore, a statistically significant difference was also found in the perceived level of technology integration between teachers who received InTech training through the redelivery model and those with no InTech training. Calculation of eta squared yielded an effect size of .47. According to Cohen, (1988), a large effect is represented by these results.

Additional information pertaining to teachers' perceived levels of technology integration was gleaned by analyzing responses to survey items concerning accessibility to various types of technology in their classrooms. Pearson chi-square tests were conducted for each possible response to determine whether statistically significant differences were present among the three groups of teachers. Statistically significant differences in access to a scanner, more than one multimedia computer, and a scan converter and television were found with more VSU ETTC InTech teachers reporting access to these than redelivery and non-InTech teachers. In addition, more redelivery teachers reported access than did non-Intech teachers. However, more teachers who received training through the redelivery model and teachers with no InTech training reported having one multimedia computer than did teachers trained at the VSU ETTC. Interestingly, a higher percentage of redelivery InTech teachers reported having access to a digital camera than did VSU ETTC InTech teachers and non-InTech teachers. No statistically significant difference was found among the three training groups for access to a laser disk player.

Teachers' responses to five Likert-type survey items were combined to calculate perceived levels of administrative support. A statistically significant relationship was found between perceived administrative support and levels of technology integration. Use of a Pearson $\underline{r}$ yielded the following: $\underline{r}(613) = .23$, $\underline{p} < .0005$. Squaring the correlation provided evidence that 5.29% of the variance was shared between the perceived levels of administrative support and technology integration. According to Gay and Airasian (2000), this coefficient indicates a weak relationship.

Conclusions

Phase One of Elementary InTech training has had favorable effects on technology integration in the classrooms of elementary teachers who received this training. Teachers who received InTech training through the VSU ETTC indicated higher levels of technology integration than did teachers who received InTech training through the redelivery model and teachers with no InTech training. Furthermore, a statistically significant relationship was found between the perceived levels of administrative support and levels of technology integration. Although this finding represented a weak relationship, administrative support of technology professional development, and integration is recommended. Administrators can provide support for technology integration by arranging for teachers to participate in professional development, making technology accessible in classrooms, and modeling the use of technology.

Teachers' and Administrators' Beliefs Regarding Constructivist-Based, Exemplary Practices for Technology Integration in Middle School Classrooms

By Fritzie Sheumaker

Introducing technology into classrooms as key components in the teaching and learning process involves more than providing hardware and software. The use of technology must coincide with how students learn best (National Council for Accreditation of Teacher Education Task Force on Professional Development [NCATE], 1997). Because the constructivist use of technology engages students in the learning process and helps them build new ideas (Jonassen, Peck, & Wilson, 1999) constructivist philosophy provides the foundation for effective strategies for teaching with technology (Strommen & Lincoln, 1992).

InTech was designed to help both teachers and administrators develop constructivist-based pedagogies and use technology as part of broader educational change and reform efforts (Holmes et al., 1998). While teachers make technology use work in classrooms (Anderson & Harris, 1997, Becker, 1999, 2000; Saye, 1998), administrators are essential to organizational change in schools (Bennett, 1996, Lambert, 1998, Stanley et al., 1998). The building principal was found to be the change agent responsible for implementing technology integration and to be an important factor in creating momentum toward exemplary technology use, constructivist practice, and improved learning for students.

Because no studies were found on the effectiveness of Georgia's InTech professional development model in promoting comparable teacher and administrator beliefs, the purpose of this study was to assess the effect of participation in InTech training on middle school teachers' and administrators' beliefs regarding constructivist-based, exemplary uses of classroom technology.

Methods

A causal-comparative research design was used, and participants included 342 teachers and 29 administrators from 10 Southwest Georgia Middle Schools. Data were gathered from each participant's responses on the Technology and Teaching Practices Survey (TTPS) and were analyzed through analysis of variance procedures. In a process labeled as qualitative contrasting case analysis (Onwuegbuzie & Teddlie, in press), qualitative data were collected through interviews with two teachers and two administrators identified on the basis of their quantitative survey scores. The selection of the interview participants was based on extreme TTPS scores with high constructivist being those respondents with a mean score greater than 5.0 and low constructivist those whose mean scores were less than 3.0.

Results

A factor analysis of participant responses on the TTPS revealed three factors related to constructivist beliefs: (a) Nature of Classroom Instruction (NCI), (b) Nature of Classroom Roles (NCR), and (c) Nature of Knowledge and Evaluation (NKE). A score was also calculated from two additional items as an indication of participants' Comfort with Using Computers (CCI). Based on the view of Feng (1995) that educators may adhere to constructivist beliefs in varying degrees, cut points for the total TTPS mean were established. An examination of the distribution of scores revealed a normal curve, and the means were then coded into a new variable labeled as Constructivist Category. A mean score between 2.00 – 3.00 indicated a participant could be termed a "Traditionalist." A mean score of 3.01 – 4.99 or 5.00 – 6.00 identified a participant as "Emergent-Constructivist" or "Active-Constructivist", respectively.

A statistically significant relationship was found between respondents' InTech status and constructivist category. With regard to all InTech-trained teachers and administrators, 11% scored at the Active-Constructivist level and 88% as Emergent-Constructivist. When only teacher respondents were considered, there was also a statistically significant relationship between InTech status and Constructivist Category with 89 % of InTech-trained teachers ranked as Emergent-Constructivist and 11% as Active-Constructivist. There was no statistically significant relationship between administrators' InTech status and their Constructivist Category.

Statistically significant differences were found based on the total TTPS mean and the NCI, NCR, and CCI subscale scores between the constructivist-based beliefs of InTech trained teachers and administrators and non-InTech trained teachers and administrators. InTech-trained teachers also had statistically significantly higher scores than their non-InTech-trained counterparts on the total TTPS and the NCI and NCR subscales. However, InTech training did not appear to have the same influence on the constructivist-based beliefs of participating administrators. No statistically significant differences were found in administrators' scores on the TTPS total score, nor the NCI, NCR, or NKE subscales. InTech-trained administrators did have statistically higher scores on the CCI subscale than non-InTech-trained administrators.

Analysis of the interview data from a Traditionalist Teacher, a Traditionalist Administrator, an Active-Constructivist Teacher, and an Active-Constructivist Administrator revealed that a school-wide shared vision for the nature of technology integration appeared to be the most influential factor contributing to teachers' and administrators' views being more or less congruent with constructivist philosophy. Other factors identified as contributing to a respondent's constructivist views were: (a) the degree of emphasis given to standardized testing when curricular and instructional decisions were made; (b) the degree of administrative support for constructivist-based instructional practices; (c) the level of comfort a respondent had with student-centered classroom roles, (d) the level of support for performance-based classroom assessments, and (e) how standardized testing demands were balanced with technology use. Both teachers and administrators viewed InTech as a factor contributing to their comfort with using computers for classroom instruction.

Conclusions

The results of this study are an indication that InTech training is beneficial to middle school teachers and administrators who complete it and may increase the likelihood that participating teachers and administrators will share a vision for effective technology use. Moreover, constructivist-based beliefs are present among teachers and administrators in Southwest Georgia middle schools with the majority of study participants scoring in the Emergent-Constructivist Category. However, concerns about student performance on standardized tests may decrease the support for and use of constructivist-based teaching strategies. Constructivism is not an end to itself; its value lies in its capacity to have a positive influence on student learning (Feng, 1995). To strengthen commitment to constructivist-based, exemplary uses of classroom technology, improving student learning outcomes should be an essential focus of the skills and beliefs promoted by InTech.

The Effectiveness of a Constructivist-Based Professional Development Technology Integration Program in Increasing Technology Utilization

By Rachelle Fowler

With the increasing availability of technology in the school systems, a key issue educators must address is the effective integration of technology into the curriculum. Although many current educators completed their professional training before the technological age in education, they are compelled to use technology that most find unfamiliar and intimidating (Armstrong, Davis, & Young, 1996). To address teachers' needs for technology skills, numerous Georgia school systems have implemented staff development training in technology through InTech, a constructivist-based professional development technology integration program. Although Georgia has taken steps to encourage teacher proficiency in the use of technology, such proficiency may not be enough to affect student use of technology in the classroom. The purpose of this study was to investigate both teacher and student utilization of technology in the academic classrooms of teachers who have or have not been trained in a constructivist-based professional development technology training program such as the state-sanctioned InTech model.

Methods

The research study utilized a mixed methods design. Quantitative data were collected through teacher and student surveys, teacher logs of technology use, and computer lab and media center sign-in sheets. Qualitative data were collected through teacher/student interviews and classroom observations. Subjects for the study included 65 teachers and 265 students at a comprehensive high school located in rural Southwest Georgia.

Results

Both quantitative and qualitative analysis of data indicated an increase in the use of technology. Teachers in the group who had been trained through the InTech model utilized technology for teacher-related tasks more frequently than they did prior to training. Data analysis revealed an increase in the use of technology for student management of grades, student information, school management, word processing, databases and spreadsheets, desktop publishing, multimedia/authoring, instructional demonstration and tutoring, information retrieval, Internet, web page development, and e-mail. Trained teachers also utilized technology more frequently for teacher-related tasks in some categories than untrained teachers. Data analysis revealed an increase in the use of technology for spreadsheets and databases, instructional demonstrations, word processing, and Internet access.

Congruently, students enrolled in the classes of trained teachers were required to use technology more frequently than they were prior to teacher training. Data analysis revealed an increase in the use of technology for computer-assisted instruction for simulations and educational games, word processing, information retrieval, databases and spreadsheets, Internet access, and electronic presentations. Students enrolled in classes of trained teachers were also required to use technology more than students in the classes of untrained teachers. Data analysis indicated a significant increase in the use of word processing, electronic presentations, and Internet access for students of trained teachers. Teachers from both groups, who required students to use technology, employed constructivist-based principles in their assignments.

Conclusions

Based on the results of analyses of quantitative and qualitative data, InTech, a constructivist-based model of professional development for technology integration training, increases both teacher and student utilization of technology. However, many factors influence the degree to which technology is implemented in a school system. Because of the importance of technology in our highly technological society and global economy, educators should continue to investigate the most effective ways to implement changes necessary for integrating technology into the curriculum.

Recommendations

The recommendation for more research is a given for the conclusion of any review of research literature. The three studies described in this paper, although all investigated InTech, were quite diverse. Three school levels, elementary, middle and high school were represented in the studies. Multiple factors in relation to technology integration training were researched, including delivery models, administrative support and student use of technology. The InTech program, in its past and current implementations, is rich ground for further empirical research, for ongoing and accurate evaluation research, and for action research in the Educational Technology Training Centers and the schools where InTech lives its daily life.

More research is not the only need; there is also a need and a promise for more InTech, or alternatives to the program. As the state supported solution to legislatively mandated technology competencies for educational personnel, there is tremendous pressure to make InTech available to very large numbers of educators in a relatively short period of time. This pressure on individuals and organizations has generated controversial discussions about the suitability of InTech training as the 'magic bullet' that will solve the technology integration 'problem'. Many school systems, regional education agencies and institutions of higher education have designed alternative programs to meet their local needs. But InTech remains the best known, most widespread and well-developed technology training model in the state.

InTech is not a static program; it is currently being extended in content and to serve additional populations. InTech has integrated experiences with assistive technologies into the basic program. A program specifically for media specialists has been developed. Some teacher education programs have used a form of InTech to train their pre-service teachers. Higher education faculty have participated in InTech in partnerships with pre-service or in-service teachers. A program based on the model for higher education faculty is in the planning stages. A second, more advanced, level of InTech is in a pilot phase and may answer criticism that the basic InTech doesn't go far enough toward true integration of technology into teaching, learning and the curriculum.

Whether technology integration training is called InTech or not, there is a need for more of it. But such training must be based on real needs of real people. The support and incentives for participation and implementation into the curriculum must be in place. Research can provide data upon which to base these programs, and can provide rationales for continuation or expansion. Support and incentives must be provided at the state and local levels in order for individuals to really buy into the potential of technology to improve teaching and learning.

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Teachers' Perceptions of Technology: Four Categories of Concerns

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Introduction

Today, many educational institutions have been challenged to integrate technology into their work settings. Technology is a mean of supporting goals related to increased student involvement with complex, authentic tasks within classrooms and schools (Scheingold, 1991). However, successful technology integrations are sometimes confronted with several difficulties, which include clients' resistance to change (Conner, 1992; Collins, 1991) or the lack of cooperation of the part of the people involved in that change (Kemp, 1996).

Recently, researchers argue that an innovation without considering clients' needs or concerns usually resulted in resistance to change (Ertmer, 1996; Hall & Hord, 1978; Dormant, 1986). The reason for this problem is a lack of attention to the clients' attitude, perceptions, and concerns that people form toward innovation. These concerns play an important role in the innovation process as well as in the inherent quality of the proposed change (Pershing, An, & Lee, 2000). Hence, identifying and addressing concerns and perceptions are an essential task of change agents during the whole innovation process. In this article, I will introduce a framework for analyzing clients' concerns and perceptions based on an information technology project that has been implemented in a seminary setting during the last five years. While conducting interviews with the teaching faculty members who participated in the information technology project at a seminary, I identified four categories of concerns. In this article, I will explain the characteristics of and interventions in each category of concern.

Context of the Case

In the mid 1990s a seminary in the Midwestern United States was awarded an externally funded grant for a technology initiative, which included developing instructional computing capabilities throughout the school (Saint Meinrad, 1995). The seminary hired two instructional interns to provide computer training to the seminary faculty and staff. At the beginning phase of the initiative, the interns conducted a training needs analysis. The main focus of the analysis was to gather information about the kinds of training programs faculty and staff members would need. Through the analysis, however, several concerns surfaced (Saint Meinrad, 1998). For example, the faculty members did not seem to think that computer technology was a tool useful for theology education, which emphasizes personal interactions within small groups. Administrators of the initiative, however, did not pay much attention to this perceived concern. They proceeded on the assumption that faculty members always complain about new initiatives, and they viewed such concerns as natural. They assumed that faculty members would eventually accept and use computers provided the faculty members received the proper training. With these assumptions in place, the administrators put effort into collecting and addressing training needs information while ignoring their concerns.

After the interns had provided in-service training for one year, they began to make informal visits to the classrooms, computer labs, library, and the faculty resource center. They found that many faculty members were not integrating computers into their teaching. According to the project implementation plan, almost all faculty members should have been using computers in their instruction after one year, since all the necessary facilities and training had been provided.

Faced with such resistance, the administration began to take the idea of concerns seriously. The administrators of the seminary learned it was not the lack of facilities or training, but concerns of the faculty that affected the success of the initiative. With this realization, they asked the interns to conduct a concerns analysis. One-on-one interviews and document analyses were used as data collection methods. All twenty-six teaching faculty and several administrators and staff of the seminary were interviewed (Lee, 2001). After conducting many rounds of card sorting, the interns identified four categories of concerns as below.

Category I: Concerns of Individual Incompatibility

Faculty perceived that the project was not compatible with their theological values or past personal experiences. These concerns had a critical influence in the earlier stages. Some faculty who understood and were well informed about the project, however, had not embrace it because of their perception of technology as opposing theological pedagogy. If they were not persuaded during the earlier stages, then it was hard to accept the project. Hence, this area of concern was critically important in the earlier stages of an innovation project, but its importance declined in the following stages. The following are several representatives of this area of concerns.

Conflicts of Needs between Institution and Faculty Regarding Technology

A definite incongruence existed in needs between individual faculty and the seminary as a whole. The institution had emphasized that technology was the only tool to increase learning effectiveness in the information age. However, to the individual faculty, using technology was just one of many ways to improve learning methodologies. As one faculty pointed out, to accomplish the goal, it was not necessary to incorporate technology, because technology was not the only way to accomplish the goals. Furthermore, overemphasis on technology at the beginning stage of the project negatively influenced all faculty members.

Skepticism about Technology

Ten faculty members among the 26 were very skeptical about technology. This resulted from their not being aware of the worth, potential benefits, or value of technology. Also, they were not convinced that technology was indispensable for their academic setting or their personal lives.

Paradigm Paralysis

Fourteen faculty members out of 26 expressed this category of concern, which was the largest barrier to adopting technology among the faculty members of the seminary. This concern can be broken down into two sub-categories: the faculty's perception of technology as opposing theological pedagogy, and the faculty's comfort with current teaching styles. Faculty members thought that technology (or the information technology project) was basically incompatible with their theological context.

Theology, they argued, should focus on nurturing human nature, which is only possible with human interactions between instructors and students. In this point, they felt that their particular theological discipline could not adapt itself to technology because theological educators are suspect of the value of technology beyond the basics of classroom pedagogy. The other reason is that they believed their current teaching style had worked well for several decades, so there was little desire to take the time to change it.

Fear of Technology

Nine faculty members expressed fear of technology in two forms: fear of the unknown and fear of the new. Some faculty were afraid something would go wrong with the computers. Most faculty said that they had not grown up in the technology culture. To them, technology was a foreign area. Even adopters of the innovation expressed concerns that technology had advanced so drastically that keeping pace with the advancement of technology seemed impossible.

Laggard Syndrome

Nine faculty members perceived themselves as being far behind in using technology. One faculty who used technology in his classroom setting even expressed that he was at the knowledge stage, still trying to find out the benefits of technology.

False Information/ Irrational Belief

Seven faculty members sympathized strongly with the criticism that technology is not a learning tool proper for the seminary. Some faculty mentioned that technology is a deterrent to human learning and communication. Those arguments were not based on scientifically proven facts but were based on personal feelings or subjective reflections. However, these feelings have not allowed them to see the potential benefits of the technology.

What effective interventions should be needed to address this category of concerns? Rogers (1995) indicated that person-to-person communication is important to address this area of concerns. Dormant (1986) also suggested that change agents should be counselors who draw out concerns, and listen to and clarify the adoption units' needs and interests. Hence, individual persuasion is a useful strategy to address this area of concerns by providing counseling and consultation sessions. The seminary realized that persuasion on an individual basis was the best strategy after noticing faculty's resistance to the innovation.

The seminary recognized that a core group was very skeptical about technology even after several years had passed since the innovation started. To identify their concerns, the seminary conducted one-on-one interviews with faculty members to become aware of the many issues that related to this area. The seminary stressed that Instructional Service staff were not attempting to change faculty's teaching styles, but to enhance their teaching styles with the use of technology. Also, the seminary published a monthly technology newsletter, both in print and on the intranet, featuring articles on the individual-incompatible area of concerns. Several faculty members wrote articles mentioning their successful experiences with technology in their teaching settings. The seminary provided opportunities for faculty members to visit other advanced technology-driven education institutes or learning opportunities to familiarize them with the practical applicability of technology in the seminary context. Also, more than ten faculty members attended technology-related seminars, conferences, and workshops.

Category II: Concerns of Unknown

Even when the value of an innovation is compatible with the target audience's values, the individuals of the adoption units may not accept the proposed innovation as planned for several reasons, including fear of the unknown and lack of information or knowledge required to implement the innovation. In the earlier stages, the individual faculty usually felt fear of the unknown or fear of lacking required knowledge or skills. The following are the typical examples of this category of concern.

More Work

To eight faculty members, technology was one more burden that they had to learn. Technology adds or creates another task. Even faculty who used technology in the classroom expressed this concern most often. To learn technology was becoming increasingly stressful and time consuming for the faculty members.

Lack of Detailed Information about the Project

The vision of the project was not address well to all faculty members. The lack of vision also made it difficult to set up the details for diffusing the innovation. Five faculty confessed that they were not aware of the detailed tasks in relation to the innovation. They expressed concerns about how technological innovations were to apply to the particular learning environment.

Teaching/Mentoring Concerns

Providing individual teaching or mentoring was an effective means of adopting the technology by faculty members. Individual training was preferred over group sessions by the school faculty. Several reasons were expressed. The difficulty of finding a common time among faculty members and consideration of individual pacing were major reasons.

Time Conflict

Eight faculty mentioned that time was one of the most important concerns in their not adopting technology. They said that technology was not a priority to them, for their primary responsibility was to prepare a class or preach. Some faculty had not even tried to learn technology because they worried about how much time would be spent.

Students' Unfavorable Attitudes toward Technology

Students' unfavorable attitudes toward technology were also mentioned by two faculty members. Ironically, faculty members who had unfavorable attitudes toward technology mentioned that students showed the same phenomena. Two faculty expressed that students did not say that the technology helped them. That made some faculty not use much technology in classrooms.

Lack of Information about Good Applications

Four faculty members said that it was hard to find someone who had applied technology very well. There was no easy way to identify other faculty members on campus who had already begun to use technology effectively in their teaching. And for most theological disciplines in particular, there was no comprehensive, easy-to-find source of information about relevant instructional applications of technology. While the number of locally successful models of educational uses of technology continued to increase, access to good descriptions of those models, training for them, and reports of their strengths and weaknesses were not easy to find.

The major strategy for addressing this category of concerns is learning, because usually these concerns can be overcome by providing well-organized training programs, job aids, and consultation programs. Also, providing correct information in a timely manner is another useful strategy to address this area of concern. However, the faculty's learning focus changed from general and basic issues of technology to more elaborate and complicated issues, such as transferring or applying the technology in more specific contexts in this case. This is why the learning format changed over time from the general group-based to the individual customized format.

To identify issues in this area and set up learning interventions, the seminary conducted a needs analysis project by conducting interviews with each faculty member as well as mailed surveys (Saint Meinrad, 1998). Based on these phenomena, several learning interventions were arranged in the seminary. First of all, an individual learning road map for each faculty member was developed. According to the road map, the well-organized technology training programs were provided for the following year. The interns had been working on-site on a weekly basis. After taking these programs for one year, the faculty improved their computer competencies from 2.5 out of 5 on the Likert scale to 3.1 in the same survey (Saint Meinrad, 1998). As the faculty moved deeper into the innovation, the focus of learning shifted to more individualized consulting and one-to-one training sessions. Also, remote consulting was offered by using electronic communication channels between the faculty and the outside interns.

To address time concerns, the seminary formed a committee to reorganize teaching loads. The recommendation of the committee was that the eclectic courses could be cancelled if few students enrolled, so the faculty could be learning at that time instead of teaching the course. Also, lack of time to learn was the most crucial factor in this category of concerns in this seminary. To address this concern, the seminary developed a training schedule that was flexible, meeting at different hours of the day, even evenings, so that the faculty could best take advantage of the offerings.

Category III: Concerns of Organizational Support

The organizational-compatible concerns were salient factors to be considered at the middle stage of the project at the seminary. Faculty who understood the benefits of the innovation did not adopt it because there were no organizational encouragements to do so. Many faculty members expressed concerns about the lack of organizational supporting systems and motivational systems. The following remarks are the typical expressions of this category of concern. The following are several representative examples of this category of concern.

Equipment and Maintenance Problems

Several concerns were expressed in this category by seven faculty members. First, the faculty experienced difficulties when servers went down, especially after hours or on weekends. Some buildings were not equipped with technology. Not much software was installed in the Faculty Resource Center (FRC) or the Educational Technology Center (ETC), which made programs hard to access when needed. Services from maintenance persons were hard to find or untimely when computing problems occurred. Students may not have had support from the seminary to fix their computers if the computers had problems.

Students' Limited Access to Equipment and Support Services

Three faculty members of the 26 mentioned that students' opportunities to access technology were limited. Not all the students' rooms and classrooms were wired. Some students could not access the technology, so electronic communication was sometimes impossible. Also, the computers in the student production center were so old that students could not use advanced software.

Students not Involved

Three faculty members mentioned that students were not involved in the innovation from the start. It was directed to the faculty group only and it began without asking how students would learn or use the technology.

Lack of Organizational Benefits

Lack of organizational benefits and motivational factors were mentioned by seven faculty members out of 26. The institution did not recognize the adopters of the innovation. Two faculty mentioned they might have adopted it if the institution had offered some motivation or incentives, such as monetary benefits. Suggestions of non-monetary benefits were also mentioned, such as vacations and training opportunities, and to lessen the teaching burden.

Distrust and Poor Communication Among Stakeholders

There was little communication and coordination among stakeholders during the innovation diffusion process. The innovation initiators did not even try to gather ideas from the three constituent groups, faculty members, staff, and students, in order to make the most effective uses of technology, new approaches to teaching and learning, and other available resources in the seminary setting. Six faculty of the 26 expressed problems with innovation in this category.

This area of concerns is relatively easy to measure and to eliminate if addressed carefully and in a timely fashion during the innovation diffusion process (Fisher, Wilmore, & Howell, 1994). Traditionally, most change scholars have overlooked these concerns at the beginning. However, in order to lead a successful innovation project, the plan has to be reviewed regularly during the innovation process. Raising money, allocating resources, and providing technical and administrative support, including incentives or motivational systems, are essential elements.

These concerns can be eliminated by acquiring resources and equipment, providing timely technical and administrative support, providing incentives or benefit systems, and maintaining equipment. Foa (1993) pointed out that incentives, support, and reward structures are needed in order to make the efforts of the individuals more widespread and their results used more comprehensively. Major problems for the seminary lay in the institution's failure to provide motivation or incentives to encourage faculty members' active usage of the innovation. Many faculty suggested both monetary and non-monetary benefits and motivators, such as vacations, training opportunities, and a lessened teaching burden. While not providing any monetary benefits, the seminary provided many forms of non-monetary benefits, such as providing training programs and visiting other technologically advanced schools. The director of the Academic Computing Department became a member of the president's cabinet, a group of advisors to the president, and thus was directly involved in developing a new master plan, which included major renovations of several buildings over the next five years.

Category IV: Concerns of Organizational Incompatibility

Last category of concerns is related to the organizational incompatibility. Faculty expressed that the innovation was not compatible with the seminary culture. The seminary culture was oriented toward more human interaction, and focused on formation-building. Furthermore, the seminary was isolated geographically, as well as divided by disciplines. They also expressed their isolation regarding the innovation. The innovation was initiated in a top-down manner. They did not receive information in a timely fashion. Clear goals and directions for the innovation were not given to the faculty. Furthermore, faculty tended to work individually rather than in teams. Every faculty member understood the innovation differently. Hence, they perceived that two incongruent innovation diffusion tracks existed in the seminary: the individual faculty track and that of the institution. This concern began to increase in importance after addressing the individual-incompatible concerns, but increased strongly in importance at the implementation stage during the diffusion process. The following are several examples of this category of concerns.

Isolated Culture

The cultural characteristics of the seminary, 4 faculty argued, were not compatible with technology. First, in preparing people for the ministry, the top priority of the seminary is fundamentally different than preparing people to teach in other higher educational institutions. The use of technology can be maximized mainly in the latter setting. Religious organizations such as the seminary must emphasize the value of forming and building relationships, which does not embrace technology. Hence, some faculty mentioned that technology was not a driving force at the seminary. Second, faculty had not grown up in a technology culture. Some faculty mentioned that the European learning model, which mainly uses lecture format in classrooms, had influenced the faculty members who had studied in Europe, who were the majority in the seminary. Third, the individuality of faculty members was another cultural characteristic. Most of the faculty pursued different disciplines and different areas of interest. That was the major reason why faculty were accustomed to working individually rather than in teams, which the innovation sometimes required them to do.

Class Characteristics

Another reason for incompatibility originated from the class contexts that were small-group class setting and technology was not related the course content. Five faculty members argued that technology could not make an impact in a small class. Most of classes were populated by fewer than 10 students. In this situation, technology was ineffective for increasing learning. The other reason why the faculty did not utilize technology during class was their perception of the inability of the course to embrace technology.

Sharing and Showing

Learning technology was one of the biggest concerns of the faculty members. Nine faculty members of the 26 expressed this type of concern. Sharing information about, or experiences with, technology among faculty was vital, and it could have been a strong influence on the faculty as a whole. Partly owing to a lack of vision for the innovation and to a lack of concrete examples of how to apply technology in a seminary setting, the faculty wanted to see other people's experiences and or knowledge.

Not Having a Clear Image of the Project

Eleven faculty out of 26 expressed a lack of vision for the project from the beginning. This area of concern was the second largest barrier for the faculty. They argued that the innovation project was started by grant money rather than a vision. Without serious questions about why this innovation was needed in the seminary, the institution started the innovation, and this made it difficult for the faculty members to grasp the vision or purpose of the innovation.

Fragmented Technology Planning

Five faculty members argued that the innovation was started without considering the necessity of information technology carefully in the context of Catholic pedagogy. They expressed that the innovation was focused on teaching rather than learning, and focused on media rather than methods. Two faculty criticized the innovation for starting in reverse order, selecting media (buying computers) without considering methods. One faculty mentioned that this project had missed one critical stage in the beginning: needs assessment or values clarification.

Collaboration was the most useful strategy to address this area of concern in the seminary. To address issues of this area, the seminary's geographical isolation, diverse faculty disciplines, and a top-down diffusion strategy, collaborative work among the faculty was essential. For example, creating a vision statement and sharing the innovation-related experiences with other individuals in the adoption units were helpful tasks in the seminary.

The seminary formed an ad hoc committee to set up a clear vision for technology and teaching at the seminary. The committee developed a vision with consensus from all faculty members and reported their findings to the faculty. Another intervention was to arrange several learning events in order to facilitate collaborative work among faculty members in the seminary. Through these events, faculty members shared their ideas with other faculty members. Sharing among faculty was the key activity for changing the seminary culture. These events included faculty presentation day, faculty learning day, small group interests, brownbag lunches and learning sessions. Also, through the funds from the grant, many faculty took advantage of conference opportunities to gain more knowledge about the appropriate use of technology. Furthermore, the seminary developed contacts with other schools facing the same issues and was able to find and demonstrate good practices in technology for theological instruction.

Concluding remarks

Information technology is an effective means of increasing teaching and learning effectiveness in higher educational settings including seminaries. However, it must be well planned and organized before the project begins. Identifying clients' concerns and taking care of them are an important task of change agents during an innovation process. Setting up a vision statement, conducting perception analysis, and preparing detailed plans for the project would guarantee a successful implementation of an information technology project in a higher education setting.

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Developing a Scaffolding System to Support Mathematical Investigations

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Abstract

This paper looks at the analysis leading to and design of a Web-based "hint system." The hints are designed to help middle-grades teachers participating in a mathematics professional development effort called InterMath achieve a high degree of success when working open-ended mathematical investigations. We discuss the issues and processes involved with designing this system, paying special attention to the different types of hints and the limitations of the system.

Background

InterMath (http://www.intermath-uga.gatech.edu) is a web-based, technology-intensive professional development experience for middle school mathematics teachers. The professional development effort is aimed at furthering teachers' mathematics knowledge, providing experience with using a variety of tools to promote learning, and supporting meaningful technology integration for middle school mathematics classrooms. The model upon which InterMath is based assumes that teachers who experience learning in a rich, exploration-based environment will more readily transfer these kinds of experiences to their classrooms. The centerpiece of the InterMath experience and website is an extensive set of open-ended mathematical investigations that can be explored using various technologies (e.g., Excel or Geometer's Sketchpad). These investigations form the central experience of the fifteen-week workshop as teachers are encouraged to explore a particular set of explorations (e.g., triangles or functions), choose problems that intrigue them, work those investigations, and write-up the solutions, along with extension activities.

Unlike the traditional "make and take" professional development experiences, InterMath does not aim to provide teachers with activities they can take back to their classroom and use. Instead, InterMath provides teachers with opportunities to hone their mathematics skills, reinforcing both their understanding of mathematics and their ideas about what it means to learn (and, thus, teach) mathematics.

InterMath is in its third year of development and implementation. During the pilot workshop offerings in Year 2, there were two InterMath workshops conducted by two different faculty members. One workshop was offered near Atlanta as the first course in a cohort-based graduate degree program for middle school teachers. This workshop was taught by a mathematics education professor who is also one of the developers of the InterMath program. The other workshop was offered at the University of Georgia campus by a professor of mathematics. The participants in the UGA workshop received staff development credits for their experience, as well as a stipend.

The Problem

Our initial work with teachers indicated that one of the challenges of InterMath is that the teachers are uncomfortable engaging in problems that they do not feel confident in their ability to finish. The teachers tend to work the easier problems first – and may not ever work the problems they perceive as being the most challenging. However, those challenging problems may be the ones that provide the greatest learning experience. Our interviews with teachers and classroom interactions indicated that there were multiple reasons for these problem selection behaviors. The most troubling reason, however, was an avoidance of mathematics that was viewed as difficult.

To further complicate the situation, teachers in our pilot workshops were considerably more challenged by the variety and uses of technology required for success in the workshop than we had anticipated. We expected teachers to be able, by the end of the workshop, to use Geometer's Sketchpad, NuCalc, and Excel, as well as to be able to create and publish a webpage using a WYSIWYG editor and FTP software. While most of the teachers had already completed a basic technology workshop series, they had little to no experience using technology to support learning in a particular content area. Further, many had little hands-on experience in using the computers with their students to support mathematics of any kind. In short, InterMath requires teachers to be comfortable with many pieces of technology, as well as to develop a concrete image of what technology can help them accomplish in their content area.

It was determined that these problems were serious enough to warrant additional support structures being created to support teachers in successfully expanding their own content knowledge as well as their pedagogical content knowledge. To this end, it was decided that some form of online help or hint system needed to be developed for the InterMath problem set that would allow teachers to be more successful in their interactions with our materials.

This paper describes the design process to date and discusses the implications of our analysis phase on the kind of hint systems we are working on. To date, we have completed the analysis system and have implemented a rapid prototyping (Tripp & Bichelmeyer, 1990) approach to help explore the potential of each option. Further, we have completed an initial paper-based design of the "constructopedia," a separate aspect of the InterMath scaffolding system that will be discussed later in this paper

An Analysis of the Problem

The analysis portion of the hint system project occurred during Winter and Spring 2001. Data were collected in the form of conversations – both live and via email – with a variety of subject-matter experts who are participants in the InterMath project, as well as observations and informal interviews of teachers involved in the pilot workshop. The discussions among team members were a rich source of data for thinking about what we value in the learning process and what matters in how we interact with the learners.

Learner Analysis

Information was collected during each InterMath session through both formal and informal means. InterMath instructors and facilitators informally observed activities and comments while teaching and while circulating to check on participants' progress and to provide them with technological and mathematical assistance when needed. Formally, at least one person was designated as the class observer each session and took detailed notes regarding events that occurred in class, including participants' actions, comments, technical problems, successes, and mathematical difficulties. In addition, many participants were interviewed at the conclusion of the workshops. The informal and formal observations, along with transcripts of the interviews, provided a wealth of information regarding the difficulties the workshop participants had experienced and how the InterMath experience could be changed to better benefit teachers in future InterMath workshops.

As anticipated, an analysis of the data provided much insight into the InterMath experience from the perspective of the teachers enrolled in the class. While every participant said that he or she would recommend or have already recommended InterMath to other teachers, their comments provided valuable information about problems they experienced during the course. Some teachers noted how time-consuming problems can be and how many problems on the InterMath website cannot be used with their classes without modifications. However, two other issues were mentioned repeatedly as the predominate difficulties teachers faced in the workshop – difficulties with the technologies being used and problems with the mathematics itself. This paper addresses the second of these two issues.

A number of the participants expressed frustration over the difficulty of many InterMath problem sets. Some of the participants noted that they do not have strong backgrounds in mathematics, while others described the mathematical rustiness that has occurred while teaching middle grades math.

> *"There's some of the math that, right now, I don't think I have down pat."*
>
> *"I don't have a very strong math background, so I struggle with a lot of the problems.... I mean it's been a long time since I've been in a math class. I know this is a graduate class, but I've only been teaching 7th grade math and there's only so much that we do – so the vocabulary and all is unfamiliar to me."*
>
> *"A few of them it's going to take some brushing up on – because as a 7th grade teacher, there are a few things that we don't hit in 7th grade."*
>
> *"That's the hardest part. Sort of bringing out the true math that's behind it. Because I don't know if I know enough to do it."*

Many participants noted in their interviews how helpful the assistance from course facilitators was when technological or mathematical impasses were experienced.

> *"Brian and Shannon have been wonderful. They've talked me through so many [problems]."*

> *"I think the very best part is probably the instructors – the people that are helping out.... Because they're so understanding and they don't act like you're stupid when you don't know how to do something."*

These comments alone give sufficient cause to consider creating some type of mathematical scaffolding system for the InterMath workshop InterMath workshop, as InterMath personnel are not always on hand when the teachers are working on their problem sets.

In describing how their ideal math classrooms would operate and how they believe students learn, some teachers revealed the importance they place on scaffolding their own students, further prompting InterMath designers to consider the implementation of a hint system.

> *"I can steer them and give them hints. And it also helps if they're going in a completely wrong direction. I can hear that too and steer them the right way."*

> *"I teach 6th grade – so some are way over their heads and some are more appropriate. So I kind of have to give them a little bit of guidance and they know what they're looking for. If you just let them go blindly, then they're gonna, they're gonna get lost."*

Based on the information gathered throughout the course of the InterMath workshop and post-workshop interviews with the participants, it seemed obvious that a hint system would be a beneficial addition to this professional development endeavor. The goals of this system would be to encourage teachers to select problems that are more difficult than those hey might otherwise attempt, assist them in furthering their mathematical thinking and understanding, and decrease the frustration that can occur when they come to a point where no more progress can be made without some type of assistance.

Hint System

Because the teachers needed more support than could be offered in the workshop and because our team could not be available all the time, we decided that an online system to support teacher learning anytime, anywhere was a critical element of the support system. To this end, we determined that developing some form of scaffolding system would be appropriate. By adding a "hint" to the more complicated problems, we may be able to aid teachers in persevering to become more successful problem-solvers. These hints may focus on the mathematics or on the use of technology to support the mathematics. We are striving to balance between providing too little and too much support to the teachers.

One of our primary concerns in considering this support system has been that it may inadvertently limit the cognitive growth potential for users of InterMath. Based on our initial field test of the hints, this concern is well-founded. Teachers in our test group clicked on the hint before they attempted to solve the problem on their own. The static hint system cannot provide the cooperative problem-solving effort between the learner and a more knowledgeable other that defines scaffolding (Collins, Brown, & Newman, 1989), nor can it anticipate exactly when the learner may require assistance. Learning in this environment comes from engagement in the problem-solving process, therefore the learners need to be actively involved in the process in order to benefit. If they click on the hint before struggling on their own, the potential of the learning experience may be significantly weakened. Further, the hint system needed to push thinking forward and promote metacognitive engagement rather than provide a crutch that eases the cognitive involvement of the learners and results in over-reliance in the system over time (Kao & Lehman, 1997).

Another issue that arose in the analysis phase was the purpose of the hints. We identified three distinctly different purposes hints might serve. The team also explored some of the arguments against developing an online scaffolding system. Because of these concerns, we were working toward developing a system that attempted to use only questions or tools that the learners will be able to use on other problems and in other ways (Polya, 1981). In this way, we aimed to develop a tool that, while static, might support the development of transferable knowledge for the learner.

No Hints

The arguments against the hint system arose from our beliefs about learning and our previous work with teachers supporting students in computer-based environments (e.g., Hawley & Duffy, 1998). In addition to the concern that the hint system might become a crutch, we were further concerned about the ability of an online scaffolding system to provide the kind of help the learner needed at the time he needed it – his zone of proximal development (ZPD) (Vygotsky, 1978). After all, the online system cannot sense where the learner is within a problem, what the learner's mathematical knowledge is, or whether the problem is a technical one (e.g., not knowing how to construct a shape or write a formula) or a mathematical one (e.g., not knowing how to approach a problem). It was the "inside help" that we felt the system could not provide (Polya, 1981). That is, the computer is not sensitive or "intelligent" enough to provide the learner with the kinds of questions or suggestions that may have occurred to the student – and those are the questions that move the student to new levels. This kind of help assumes that there are some general ideas that can guide the learner from one problem to another. This is in sharp contrast to "outside help" which should be treated as a last resort (Polya, 1981).

Additionally, the use of a static hints system in an online setting requires the student to be responsible for "fading" the scaffolding. It is unclear that learners can effectively self-monitor to determine where they are in their own ZPD. It is clear, however, that fading is a critical part of the scaffolding process (Kao & Lehman, 1997; Oliver & Hannafin, 2000). Therefore, finding ways to provide support without over-supporting became a theme in our development process.

Finally, the static hints system is problematic in that scaffolding is often considered an interactional approach (Driscoll, 1994). It, ideally, provides for an interaction between two people that can evolve and/or fade over time. The reciprocal teaching research (e.g., Palincsar & Brown, 1984; Brown & Palincsar, 1982) provides a compelling description of a scaffolding system that exemplifies this approach. Our design team considered how or if the hint system could serve as a scaffolding device without this kind of teacher-learner interaction.

While compelling, the arguments against the hints system did not provide alternatives for supporting teachers in attempting or completing the problems that offered the most promise for their mathematical development – the "hard" math problems. Using Bruner's view of scaffolding, we wanted to protect our learners from frustration (Bruner, 1981). Therefore, three different approaches and views of the content-oriented hints were considered: hints that aimed to keep the teachers motivated, hints that aimed to provide generalizable strategies for the learners, and hints that modeled expert thinking for the teachers. The first kind of hint sought to provide scaffolding that supported the teachers through the rough spots and helped them feel successful. The second and third kinds of hints served the purpose of trying to help the teachers become more expert-like in their approaches to mathematical problem solving.

Motivational Hints

Occasionally teachers in the InterMath course became frustrated after working on a problem for an extended period of time without making any headway. Sometimes the teachers would give up on problems such as these and move on to less challenging ones. As InterMath is a professional development environment, one in which teachers are encouraged and expected to develop and expand their mathematical understanding, this "avoidance behavior" played a large role in our decision to develop the hint system. We believed that such a system would motivate the teachers to choose and persevere with more challenging problem sets.

In describing general principles for motivating people, Ford (1992) describes the importance of providing indirect facilitation for goal attainment, rather than controlling learners' actions. In our case, the hint system would be that facilitation, which, for some teachers, would be the determining factor for whether they would choose a more challenging problem over a simpler one. This is particularly relevant because problems are not *assigned* to teachers in the InterMath course; teachers *choose* which problems they wish to explore, giving them more ownership of the process.

Along with the notion of learner control comes the idea of self-efficacy, or learners' judgments about whether or not they can succeed at specified tasks (e.g., Bandura, 1989; Pajares, 1996). It was our hope that providing a hint system as scaffolding would increase learner's feelings of self-efficacy, increasing their likelihood of choosing more complex problems and expanding their mathematical horizons.

Self-efficacy is closely tied to the concept of personal agency beliefs (Ford, 1992). Ford describes these beliefs as the evaluative thoughts comparing a desired outcome (successful completion of a problem) to an anticipated outcome (successfully and easily completing a simple problem, or possibly failing to correctly complete a more difficult one). Ford believes that in addition to *being able to* achieve goals, learners need to *believe* in their abilities to achieve them.

> *Personal agency beliefs are often more fundamental than the actual skills and circumstances they represent in the sense that they can motivate people to create opportunities and acquire capabilities they do not yet possess.* (page 251)

We hoped that providing the hint system as scaffolding would increase learners' estimations of their own abilities to solve difficult mathematics problems, improve their success rate when they do choose these problems, and provide a "safety net" in case they do become stuck on the problems. We believe that a motivation-guided scaffolding system will ultimately help teachers to achieve the ultimate goal of InterMath – improving their understanding of mathematics.

Table 1: Motivational Hints for "Penning for Pony" Problem

Problem: To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec1994).

Hint 1: Is it possible to relate the amount of fencing in terms of the side length of one side of fence?
Hint 2: What equations can be written to relate the side lengths created by the fencing?

Generalizable Hints

Because of our team discussions, we decided to explore multiple forms of hints for this system. To this end, Polya (1957) provided the basis for our thinking in the development of the second kind of hints – those that support the development of transferable, generalizable problem-solving strategies. Polya identified a four-step problem-solving process that includes a number of substeps. The four key steps are: (1) Understand the problem; (2) Devise a plan; (3) Carry out the plan; and (4) Look back. In reviewing the process and reflecting on the kinds of challenges the teachers we had worked with thus far faced, we determined that providing hints that helped the learners work in phases one and two of Polya's work would be most beneficial. To this end, a set of hints that provided both the strategy (e.g., "Can you restate the problem?") and a specific hint for the problem of interest (e.g., "Before you answer the given problem, think about the definitions and formulas of circumference and area. On what part of each circle do you really need to focus? How do these parts relate to each other?"). The goal was to support the learner through a combination of macro- and micro-level scaffolding (Guzdial, 1994).

The goal of transfer in this static environment is a difficult one to achieve. Research has indicated that the greatest opportunity for transfer involves an active system in which the hints become more specific as needed (e.g., Bransford, Brown, & Cocking, 1999; Campione & Brown, 1987). This graduated prompting provides a way to more actively engage the learner as a partner in the scaffolding system. Due to the limitations of a static hints system, we could not offer the progressive drilling into an area that a teacher could, though we did explore that option. Instead, we chose to provide a set of hints rather than one that provided the learner with both the general hint and the specific. Our intention would be for the learner to be self-regulating in choosing to use both the hints system itself and the specific hint.

Table 2: Generalizable Hints for "Penning for Pony" Problem

Problem: To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec1994).

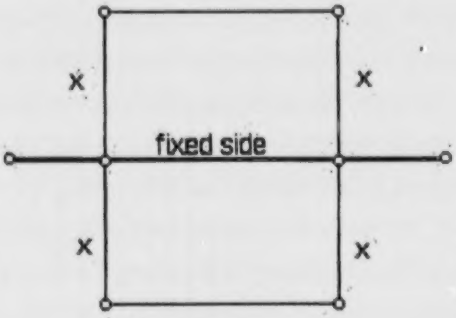
Strategy 1: What are the data? What is the condition?
Hint 1: What does the ninety-six meters of fence tell you about the rectangular pen?
Strategy 2: Go back to the definitions.
Hint 2: How do you find the area of a rectangle? How do you find the perimeter of a rectangle? How are the area and perimeter of a given rectangle related to each other?

Model Hints

Wood, Bruner, and Ross (1976) define the expert's role in scaffolding as directing and maintaining the learner's attention, while also modeling the task and highlighting the critical features of that task. Our third approach to hints builds from that notion. It is well-documented that there are fundamental differences in the way experts organize knowledge and the way novices organize that same knowledge (e.g., Bransford, Brown & Cocking, 1999). Experts tend to organize thinking and strategies around core concepts whereas, more novice thinkers tend to exhibit signs of more linear and procedural understandings. Further, experts are better able to identify appropriate instances for applying theories and procedures to problem-solving instances. Therefore, if the scaffolding system were to promote the development of more expert thinking about mathematics, one possible approach might be to provide a rich set of problems for the learners to solve and provide models of expert approaches to solving those problems.

Modeling has been shown to be an effective means for supporting learning (e.g., Palincsar & Brown, 1984; Schoenfeld, 1991). It provides an example for learners to take and adapt for their own purposes. The limitation of the modeling method is that it, too, relies on learner self-regulation. If the learner does not engage in reflective adoption and adaptation of the modeled example, that learner has learned only a prescriptive task rather than a generalizable approach. With a hint system of this kind, our goal would be to support the learner to reflect on what was important in a situation. The instructor may need to spend time engaging learners in reflective activities to gain the skill necessary to do this. However, this may be a powerful way to help move middle grades teachers, notoriously underprepared in their content areas (e.g., SREB, 1998), toward developing more expert levels of content understanding.

Table 3: Model Hints for "Penning for Pony" Problem

Problem: To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec1994).
Hint 1: What if we built a similar figure on each side of the fixed wall? 
Hint 2: Use the algebraic mean – geometric mean inequality to find the greatest possible area, then use that information to determine the length of each side. (Hint 2 also includes working of the mathematical equations.)

The Design Process

Our design process ran parallel to our evaluation process. We began by looking at existing systems to see how they provided support for learners. These systems included the support system in the Knowledge Integration Environment (KIE) (Slotta & Linn, 2000), as well as EMILE (Guzdial, 1994) and CSILE (Scardamalia et al., 1992). These tools provided very different approaches to scaffolding learning, ranging from static to very dynamic and including various levels of teacher/knowledgeable other support within the system.

The tools that we reviewed ranged, also, from technologically complex to those that were relatively simple. In the end, the decision to follow a simpler path was tied to two issues: budget and time. The enormous undertaking of developing a dynamic support system was outside the scope of our efforts and was not included in the budget. Further, InterMath is a multifaceted system that includes communication tools, a dictionary, materials for instructors, and, of course, the investigations. Because each of these pieces requires support, the need to keep the scaffolding system to a manageable size was considerable. Further, the InterMath team recognized that teachers in need of more specialized support could contact an InterMath team member or could use the communications tools to pose questions to other members of the community. The trade-off with this was the loss of momentum caused by the delayed communication in an asynchronous environment. However, if we paired a just-in-time scaffolding system with these other tools, we felt we could offer support for the learners that would be meaningful.

The most critical decision made as a result of our process was the decision to split the hints system into two distinct pieces. One piece would be the hints as discussed in the analysis section. The other part would be the "constructopedia," which is a system to support teachers in completing mathematical constructions using Geometer's Sketchpad. While making constructions in this program is still a mathematical process, it is the point where mathematical concepts intertwine with technology. The support that teachers struggling with the technology needed was not the same kind of support they needed to conceptually understand the problem. The constructopedia borrows heavily from the Lego approach to instruction – teachers are provided with pictures that show the construction being put together. They are provided with minimal text as well because our rapid prototyping process indicated that the images alone were too confusing. The goal of the constructopedia is to provide teachers with the support they need, while forcing them to remain engaged in the mathematics of the construction.

A final portion of the design phase has been the identification of which investigations need hints and what kinds of hints they might need. This process was begun by having a new graduate student whose mathematical background was similar to our target audience's work several of the investigations to identify places where they became difficult as well as ways she was able to overcome those difficulties. This provided a beginning guide for the hints system. However, her activity on the project team and in graduate-level mathematics education courses quickly moved her beyond the mathematical content knowledge of our target audience. Therefore, further work to identify investigations in need of support will need to be done a different way.

The Development Process & Future Work

The analysis and design phases employed three instructional design strategies: 1) having a person similar to our target audience work through investigations to identify potential problems and discuss how those complications affect the successful completion of the problem; 2) reviewing existing computer-based scaffolding systems to explore the characteristics and possibilities of effective systems; and 3) working with SMEs on our team to determine how to translate face-to-face questioning strategies to static online strategies. The development phase introduces a fourth key strategy – rapid prototyping.

Both the constructopedia and the hints system itself have gone through multiple iterations. During the pilot courses, we were able to bring in different kinds of hints and test them out with members of our target audience. This provided extremely valuable feedback as we were able to put the hints system to work, watch the users interact with it, and talk to them about their reactions to it. Interestingly, in the audition of the hints strategies, the participants claimed that the hints were not useful, despite having relied on them to complete their problems.

We are currently involved with the development stages. There are still obstacles to overcome, including making the final decisions about which approach to the hints system to adopt. There are very practical considerations that must be weighed in this decision. For example, we must choose a hints system that members of our team can create and refine with little SME intervention. From this perspective, the generalizable hints are a strong contender. We must also choose the system that offers the greatest level of promise and that is most consistent with our overall approach. From this perspective, the model hints are more appropriate. At this point, the motivational hints have been left behind because our initial evaluation showed that participants found them less helpful than the others.

Another critical obstacle is determining which investigations need hints and what kinds of problems teachers might have with them. This is problematic because all of our team members have either extremely high mathematical ability, or mathematical ability that is too limited. To address this problem, we have considered a number of approaches including conducting more teacher observations during our next workshop offering and using our best guesses to find problematic investigations.

Conclusion

In short, we see the use of a web-based hints system as being a potentially valuable tool for supporting teachers in tackling complex math problems. We recognize that there are limitations with this plan, but see combining the just-in-time help of a static system with the asynchronous support of a wider community as a viable option for promoting the development of mathematical thinking. We are currently involved in a rapid-protoyping approach to find appropriate ways for supporting teacher development.

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Activity theory framework and cognitive perspectives in designing technology-based support systems

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Abstract

The paper conceptually elaborates the traditional concept of expert performance by Glaser et. al, and discusses a series of attributes for supporting or nurturing an environment for expertise. Then an alternative point of view from a standpoint of activity theory (social constructive theory) will be taken to see how one (instructional designer) might support an expertise in the areas of designing technology-based performance support systems.

Introduction

With the increased demand and interest in electronic performance support systems (EPSS), particularly for supporting knowledge-based problem solving expertise in the information age (Gustafson, 2000; Dickelman, 2000; Kasvi & Vartiainen, 2000), instructional designers are facing a new challenge designing a system that could deliver (or transfer) needed knowledge (expertise in a particular knowledge domain) to learners/users, because we do not really know what it is that learners need to learn to become effective problems solvers within the context that learning (or performance require) occurs (Backler, 1988). The questions include "What skilled/experienced problem solvers (or expert performer) go about solving a problem (a task)?" and "What kinds of knowledge they make use of when doing so?" In short, we do not really know what expertise is required for individual learners to perform particular tasks within certain conditions, and if we do not know this then how do we design an effective system to delivery them.

However, an alternate view of cognition has been developing over the past three decades or so: expertise researches from cognition psychology. Other researches that influence instructional design are so called: situated cognition, distributed cognition, activity theory, and other dimensions relating to social-cultural perspectives have been brought into attention by socio-culture psychology. Fundamentally, these notions stress the individual minds (expertise and mental model), the environment (or authentic contexts), and the tight interrelations among them (Hung, Koh, & Chua, 2000). In this paper, the author will focus on activity theory only.

Instructional designers are designing instructional environments both to understand the improvement of performance and to further define theories applicable to the design of conditions for learning. Therefore, the objective for the EPSS designer is for more people (novices and intermediate learners) to attain competence at higher levels (expert) than ever before. Given the notion that different performance may require different support, the EPSS designer needs to understand what knowledge expertise is required, how expertise (knowledge; skills) was acquired, for different individuals and in what conditions. To reach their goal, EPSS designers began to accommodate changes in theory and practice and did so in a way that added value to the discipline. Two disciplines that increasingly influenced instructional design are researches on expertise from cognitive psychology and activity theory from socio-culture psychology.

In this paper on the literature, the author will first give an overview of EPSS then review two areas of studies related to (advanced) EPSS design. One is expertise from cognitive psychology; the other is activity theory proposed by socio-culture psychology.

What is EPSS and why should instructional designers be interested in it?

What is an Electronic Performance Support System (EPSS)? "EPSS" is still a relatively new term in the field of corporate training and instructional design, having been first introduced by Gery in 1989. An EPSS refers to any electronic integrated system or infrastructure that can provide access to information and tools to enable individuals to achieve a high level of performance in a short amount of time and with a minimum of support from other people. According to *EPSS InfoSite*, an EPSS can also be described as any computer software program or component that improves worker performance by

1. reducing the complexity or number of steps required to perform a task,
2. providing the performance information an employee needs to perform a task, or
3. providing a decision support system that enables a worker to identify the action that is appropriate for a particular set of conditions.

Currently, corporations are benefiting from the implementation and usage of integrated electronic systems (Raybould, 1995; Kasvi, 2000; Gustafson, 2000). For example, a large corporation may combine its many electronic tools (such as databases, word processing, e-mail, and calendars) into an EPSS to facilitate ease of access and usage. By using an EPSS, information or tools are more easily accessible, thus increasing the workers' efficiency (Gery, 1991; Kavat, 1997; Raybould, 1990).

When the workplace becomes increasingly complex, quick, and accurate the speed and accuracy of information processing becomes a competitive necessity, especially in the technology-rich-rapidly changing information age. In the information age, even experts may have to struggle to maintain their level of performance (Winslow and Bramer, 1994). With advances in technology, it becomes possible to provide a variety of new forms of support to aid worker performance, promote workers' satisfaction (confidence), shorten the process of transforming a novice into an expert, and potentially reducing the amount of training they require.

The definition of EPSS varies. Among other terms used are: performance support, online performance support, performance support tool, performance support engineering, performance centered design, and Embedded Support (Gustafson, 2000). The definition of EPSS here tends to be broad and encompassing. Thus, it includes everything from the simple database that provides information to workers (for example item price and customer information) to EPSSs for the complex tasks that involve complex cognitive skills (such as air traffic control systems based on expert systems and artificial intelligence).

The elements and characters of what an EPSS constitutes also vary. Gery (1991) included four elements: an information base, advisor, tutorials, and tools to assist the user. In the past decades, EPSS design has matured; it is not limited to Gery's four elements. "Information bases may include multiple knowledge sources; advising may take on features of expert systems or artificial intelligence; tutorials may be extensive and contain contextual multimedia instruction; and the tools have become more sophisticated (Gustafson, 2000; p. 37)."

However, as an instructional designer, we have every reason to believe these trends will continue, the demand of creating/developing EPSSs will grow, and the design of EPSS will not become less complex and less challenging as the rate of change keeps accelerating.

What are these studies on expertise about and why should instructional designers be interested in the theory of expertise?

"It is likely true that all humans have some form of mental model or conceptualization of the operation and function of any piece of technical equipment (Johnson, 1988)." Whether accurate or not, understanding how humans learn and process knowledge (expertise) helps instructional designers in developing effective learning/support systems. As mentioned before, EPSS designers are interested in knowing what expertise is required for individual learners to perform particular tasks within what conditions and then how do we delivery them as instructional designers. In the past few decades, cognitive psychology has been studying and developing this.

Chase and Simon (1973) and deGroot (1965) were among the first to explore the development of expertise in master chess players and they proposed an information-processing perspective (theory) as the analogy of the human processor. Since then, a great deal of research has been carried out in the area of expertise in problem-solving areas, such as chess, bridge (Charness, 1979), physics (Chi, Feltovich, & Glaser, 1981), mathematics (Schoenfield and Herrmann, 1982), and medical diagnosis (Patel & Groen, 1986). More recently, research has expanded to the instructional design field (Rowland, 1992; Perez & Emery, 1995; Perez, Johnson, & Emery, 1995; Le Maistre, 1998; Julian, Larsen, & Kinzie, 1999), the sport domain, and parallels between sport and the more traditional cognitive tasks have been evidenced. However, with the studies to date, emphasis is the relationship between expertise and human competence in general. What we learn about expert performance and its acquisition is applicable to understanding and improving competence in the skills and knowledge learned in school and in the workplace.

1. Expert behaviors are different in terms of cognition structure (mental model). Experts have organized their knowledge into complex structures that link the abstract conceptualizations of the domain with the surface features of the system (Chi, Glaser, & Rees, 1982; Chi, Feltovich, & Glaser, 1981). The development of knowledge/expertise is acquired in such a way that it is highly connected and articulated, so that inference and reasoning are enabled, as is access to procedural

actions. In short, those organizations of knowledge provide a schema for thinking and cognitive activity.

2. The structures of knowledge expertise/skills are developed. The work of Laufer & Glick (1996) proved that the four major interactive skill components that expert performers coordinate when troubleshooting: system, procedural, strategic knowledge (macro-level cognitive skills architecture) and strategic decision factors (inform the decision-making process of strategic knowledge).
3. Learning/expertise is a continuum. The progression can be described in terms of three interactive phases: (a) external support; (b) transition (c) self-regulation (Glaser, 1996). At each different phase, the use of external support with the performer calling on competitors, performance situations, and the advice of coaches as particularly needed is very selective. In this regard, we should design improved and supportive environments for different kinds of learning (performance) (accordingly)

Putting it all together, we believe (a) cognitive performance models believed to be detailed enough to provide the criterion performance for an instructional system; (b) a developmental trajectory depicting the skill acquisition path from novice to expert; and (c) individual learning and performance differences that result in impasses or barriers along the skill acquisition trajectory (Gott & Lesgold, 2000) are important in learning/performance. Therefore, EPSS designers will be able to identify critical learning and support elements during the design process.

EPSS designers are interested in understanding how an integrated, un-simplified form of real-world competence evolves over time as well as in searching for detailed cognitive performance models that could drive effective instruction and then integrate them into learning systems (for effective learning), because real-world learning and problems are unpredictable, dynamic and complex.

Knowledge gained fromthese studies contributes to the design of optimal instructional processes for acquiring expertise, or at least facilitating its development. Most of the research cited above, however, is quite basic and was not guided by a desire to improve the process of designing EPSSs. What we would like to do here is describe an additional approach, *Activity Theory*, that has been emphasized in several recent research studies (Laufer & Glick, 1996; Jonassen & Rohrer-Murphy, 1999; Hung, 1999; Hung, Koh, & Chua, 2000; Hung & Wong, 2000)

Activity Theory

According to Hung & Chen (2000) the basic structure of an activity consists of the (a) intended object to be achieved by (b) subjects involved within the context of (c) a community where work is mediated by (d) tools, (e) rules of the practice, and (f) division of labor (Cole & Engestrom, 1991; Jonassen & Rohrer-Murphy, 1999; Kuutti, 1996). Thus Activity cannot be understood or analyzed outside the context in which it occurs.

Activity theory originated within the cultural-historical school of Soviet Psychology and classical German philosophy (Wertsch, 1981; Hung, 1999; Jonassen & Rohrer-Murphy, 1999; Hung & Wang, 2000). Following that, it was subsequently followed up by current researchers in Social-Cultural Psychology, such as situated cognition, distributed cognition, activity theory, and other dimensions relating to social-cultural perspectives (Hung, Koh, and Chua, 2000). The fundamental notion is that there are close interrelations between the individual mind with others and the environment or authentic context(s). As an EPSS designer, we need to be more concerned with the context in which learning and performance occurs, as well as the design process itself.

Knowledge is socially constructed based on the processes of internationality, history, culture, and tool mediation. The production of any activity involves individuals, the object of the activity, the tools that are used in the activity, and the actions and operations that affect an outcome (Nardi, 1996; Hung, 1999). Rather than focusing on knowledge states and representations, the work of Laufer & Glick (1996) focuses on the activities in which people are engaged, the nature of their tools, the social relationships, the contextual factors, and the goals and outcomes of activity. As a result, "learning occurs only in the context of meaningful activity, it is important to analyze the activity and the contexts as part of instructional design process (Jonassen & Rohrer-Murphy, 1999)."

Implementations To EPSS Design

Instructional designers should focus not only on the products or outcomes of learning but also on the historical and genetic processes that lead to the resultant phenomena. Hung, Koh, & Chua (2000) concluded two fundamental reasons for this.

1. Culture, though man-made, both forms and makes possible the workings of the human mind; thus, learning and thinking are always situated in cultural settings and always depended upon the utilization of cultural resources.
2. Because human action and learning are primarily socio-culturally situated, even when the individual sits in solitude and contemplates something, he or she is socio-culturally situated by virtue of the mediational means he/she employs

In addition, jobs are placing greater cognitive demands on workers. In job environments such as aviation, operating rooms, and command and control centers, especially where time-constrained decisions are critical to overall performance, there is a growing demand for cognitive analysis to support the design of job aids and training systems. Within these operational environments, cognitive analysis is evolving from research and development projects to applied cognitive analyses integrated with traditional instructional design processes (Redding & Seamster, 1994). Activity approach has been proposed in Laufer & Glicks' study (1996) for investigating an everyday work task by novices and experts.

Activity is not merely external behavior; rather, it is inextricably linked with consciousness. It is the key to understanding the relationship between consciousness and the objective world. Hence, conscious learning emerges from activity or performance, not a precursor of it. For this reason, activity theory has been introduced and used in the field of human-computer interaction (Bodker, 1991), constructivist learning environments (Jonassen & Rohrer-Murphy, 1999) and instructional design (Wilson, 1999) in order to provide a clear operational framework for designing complex learning/support systems.

These studies all emphasize the need to consider the larger context. They place an emphasis on social interaction within an activity context and the processes of internalization that take place through interaction and mediation. In this regard, EPSS designers need to understand the performer culture (organization culture) and work environment (learning context) to at least some extent in order to negotiate the needs (based on the situations) and design effective products (Wilson, 1999; Jonassen & Rohrer-Murphy, 1999; Hara & Schwen, 1999; and Hung, 1999)

The main contribution of this activity framework is that it proposes a different perspective for analyzing (examining of) work practices, as performed by people within natural settings. The framework is most useful in both ill-defined and well-defined task areas where routing and non-normal tasks have been specified through a task analysis or the ISD process. Recognizing the wide range of cognitive analysis methods, this framework (approach), in addition to the methods in ISD process, allows for studying different forms of human practices, factoring in the processes of context as developmental process, both at the individual and social levels at the same time (Kuutti, 1996; Hung & Wong, 2000).

Activity theory's approach to instructional design is clearly based on distinctly different epistemic and pedagogical assumptions than classical approaches to instructional design. According to Jonassen & Rohrer-Murphy (1999), activity provides an alternative perspective to the mentalistic and idealist views of human knowledge that claim that learning must precede activity. Activity theory posits that conscious learning emerges from activity (performance), not as a precursor to it. So activity theory provides us with an alternative way of viewing human thinking and activity. Activity theory is also a powerful socio-cultural and socio-historical lens through which we can analyze most forms of human activity.

In short, activity theory provides an alternative framework for designing effective systems by understanding the expertise of particular task/knowledge/performance, expert [as well as novice] behaviors (mental model, goals, rules, intention, motivation, social interaction), and learning context (culture, tools, objects, environments).

Conclusion

It is exciting that the development of technology provides many opportunities to enhance performance (and learning) that will involve EPSSs and other forms of environmental modification. In addition to employing classic instructional design methods, EPSS designers are aware of alternative approaches for designing and developing good instructional systems, such as rapid prototyping methodology (Jones & Richey, 2000) and concurrent engineering (Gustafson, 2000). At another level, the design of these modalities will also require alternative (or mixed/combination) approaches (such as activity approach) to understand change from a socio-culture perspective of focus from performance outcome to performance activity and the relationship of learning with their environment where learning and activities take places.

We need to design more effective EPSSs as the demand increases. It is important to know the difference between experts and novices because we can know how knowledge is transferred and how novices become experts as well as how instructional designers can support these people effectively based on the notion that different performance requires different support. However, to reach this goal, particular attention should be given to the question of how we design the environment (support system) of people and things about them, and use the situations they encounter to improve their performance. It would also be informative for EPSS designers to understand the properties of different disciplines and different situations of performance that are more or less amenable to designing conditions for improvement, and that require various kinds of participatory experiences and assisting devices for supporting performance in the course of acquiring competence.

Equipped with all the understanding and knowledge described above of how technical expertise appears to grow in the wild, the initial state of the learner and an explication of the process of learning (i.e., the transition from initial state to a desired state in an instructional setting), learners' individual differences, and the assumption of learning mechanisms (internalization, assimilation, and restructuring; Gott & Lesgold, 2000), we are ready to turn our attention to designing an instructional environment that could effectively reproduce such expert-like performance, but through systematic learning events, accelerating the lengthy process that occurred naturally (Gott & Lesgold, 2000).

With these theories, techniques and knowledge that make the knowledge structures and cognitive performance of competence explicit, knowable, and learnable, we believe a properly designed instructional environment could shorten the skill acquisition process, resulting in accelerated skill development for a group of novice learners.

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A Design and Development Model for Building Electronic Performance Support Systems

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Abstract

The proposed study is to investigate the design and development process of EPSSs. The primary purpose of this study is to help the EPSS designers by proposing a more effective and productive EPSS design and development model. By analyzing EPSS products and observing EPSS design projects, the researcher will propose a design model for future EPSS designers.

Introduction

The recent developments of technologies have been changing the way we live. Many organizations, such as business, educational or governmental settings have been challenged to integrate information technologies into their work settings. Parallel to this change, in the past decade, there has been a significant shift from traditional training and instructional systems to performance-based, individualized and just-in-time support.

As stated by Hung (1998), today's organizations convey the ineffectiveness of traditional performance support interventions, represented by both traditional training and traditional performance support technologies. Traditional interventions have helped a little, but not significantly, to move the organization successfully into the performance zone. Moreover, according to Rosenberg (1995), for a performance-based approach the concepts of students, courses, curricula and instruction have little meaning. Rosenberg, Coscurelli, and Hutchinson (1999) note that:

> The overwhelming amount of complex information required to perform work at a competent level has placed considerable strain on traditional education and training systems. This situation has led to the development of job aids, computer databases, and electronic training systems as well as of structured text design. (p.30)

Therefore, especially because of the wide availability of new information technologies, knowledge-based organizations, such as educational institutions and corporations, have started to implement and use Electronic Performance Support Systems (EPSS) to increase both performance and productivity.

Laffey (1995) indicates the goal of an EPSS as providing whatever is necessary to ensure performance and learning at the moment of need. It is agreed upon by several researchers (Gery, 1989; Gery, 1995; Raybould, 1995; Lawton, 1999; Gustafson, 2000) that, in order to improve performance and reduce the time spent on task, the ultimate goal of an EPSS is to provide performers with the right information, in the right quantity and detail, at the right time. In those respects, EPSS is different from traditional training systems.

With the help of such systems, performers receive support during performance, rather than before they perform their jobs. Laffey (1995) adds that an EPSS is not only a vehicle for delivering static information, but also a reconceptualization of the work environment that is grounded in the fluid nature of support in the work environment. This is a major shift from the traditional approach to training.

As pointed out by Raybould (2000), the major question facing organizations today is not whether to do performance-centered design, but how to get it done. Since the ultimate goal of EPSSs is to reduce the cost of training while increasing productivity and performance, they have been developed and used by many organizations during the last decade.

As stated above, EPSSs are different from traditional training and instructional systems, because their primary purpose is to support performers while doing their actual job. According to Rosenberg (1995), EPSS is a fundamental paradigm shift in thinking, and it requires a broader perspective about what is possible in improving human performance. Rosenberg criticizes many educators because they are locked in a linear cultural model that focuses on learning as an end and instruction as a means, both of which contrast with the means and ends of EPSS. This difference also makes the EPSS design and development process different. Since the overall purpose of an EPSS is different from the traditional purpose of instruction, several researchers (Milheim, 1997; Northrup, 1999) state that the use of traditional instructional system development models is inadequate for EPSS development. Northrup (1999) summarizes this difference as "instructional design is the process of designing and developing instruction to achieve specific learning outcomes, where EPSS is more focused on producing task performance" (p.

1). Rosenberg (1995) adds that involvement in building and implementing EPSSs requires a fundamental rethinking of the relationship between learning and performance. Parallel to this, the design and development of more effective EPSSs is becoming a critical issue that needs to be focused on by researchers. Therefore, since EPSS has significant differences from instruction, then the approach to its design/development process should also be different.

Significance of the Study

Several researchers state the need for a clear methodology for building EPSSs (Fisher & Horn, 1997; Gustafson, 2000; Milheim, 1997). Cote (2000) states that the focus on the "work process" makes the design and development of an EPSS quite different than the traditional models of instructional design. If the primary purpose of an EPSS is to support performance, learning is of secondary importance; and if an EPSS is different than instruction, how should it be designed?

Despite a growing number of success stories, the EPSS remains a relatively new concept and little is known about the different aspects of EPSS design. This study will create a better understanding of the EPSS design process. By observing and analyzing EPSS design projects in different phases of the production path, the researcher will propose a design model for future EPSS developers.

For this study, rather than having in-depth analysis of individual steps, the focus will be on the generic design process, with the major components that reflect the patterns of design activities carried out by EPSS designers in the field. Identifying the underlying detailed steps is beyond the scope of this study. They can be addressed in future studies.

Literature Review

It is generally agreed upon that Gloria Gery is the first person who introduced the term EPSS at the end of the 1980s (Gery, 1989). Gery (1989) and Brown (1996) define an EPSS as a self-contained, online system which is designed to integrate a knowledge base, expert advice, learning experiences, and guidance with the goal of providing individuals with the ability to perform at a higher level in the workplace and requires minimal support and intervention by others. Another EPSS pioneer Raybould (1995) defines EPSS as

> ...the electronic infrastructure that captures, stores, and distributes individual and corporate knowledge assets throughout an organization, to enable individuals to achieve required levels of performance in the fastest possible time and with a minimum of support from other people. (p. 11)

Later, Gustafson broadens those dimensions by including multiple knowledge sources, expert systems or artificial intelligence, contextual multimedia instruction and more sophisticated tools (Gustafson, 2000).

As seen from the literature, EPSS is still a young and evolving field (Moore, 1998). Therefore, even though the term EPSS has been widely used recently, there is no generally agreed-upon definition (Cole, Fischer & Saltzman, 1997; Villachica & Stone, 1999; Hannafin, Hill & McCarthy, 2000). According to Brown (1996), the best use of an EPSS happens under the following circumstances: if there is a profusion of information required to perform work at a competent level and technology explosions exist, experts are not available, expectations for performers are high, and performers have a self-directed learning style.

Similar to the case of different definitions of EPSS, there are also different views about the components and characteristics of EPSS. For example, Schwen et al. (1993) argue that an EPSS has four characteristics: information management, collaboration management, productivity through embedded guidance and work metaphor, and finally a problem solving environment that integrates basic tools, information management, collaboration and productivity tools in a seamless environment.

Hannafin et al. (2000) list the four core components of EPSS as resources, contexts, tools, and scaffolds. The ways in which the varied elements within the components are combined will vary depending upon the goals, context, and participants.

Reigeluth (1999) defines an EPSS as a computer program that provides support for the performance of a task. According to him, an EPSS usually has four major components: a database, an expert system, an instructional system and tools. These components are explained below:

- A database. A store of information that can be accessed by keywords or topical menus during the performance of a task. In addition, the database could provide access to other tools or software to help the worker do his or her job, such as spreadsheet and word processing software. "The EPSS would integrate tutorials or instructional systems and expert systems into the database, both in order to make them context-sensitive, and to allow them to share data" (Sleight, 1993, p.7). The type of data in this database may be textual, numeric, visual (photographs and video), or audio (conversations, speeches, and music). The information would be linked with related information via non-linear hypertext links, providing fast access to information, and allowing for different levels of knowledge in users. The effectiveness of an EPSS strongly depends on how well the database matches with the user's task and environment.

- *An expert system.* An expert system is a computer-based system, which emulates the decision-making ability of a human expert (Jonassen & Reeves, 1996). It can be accessed as an expert is accessed—by asking questions or receiving unsolicited suggestions—during performance of a task. It may suggest the most appropriate procedure or step to do next. Today, the terms expert system, knowledge-based system, and knowledge-based expert system are used synonymously.
- *An instructional system.* A set of methods (such as providing hints, suggestions, and guidance to move the student along) of instruction to help performers just in time for performance. It may be a list of steps to take, a motion video showing a procedure, or a simulation of a task that allows the user to practice.
- *Tools.* Programs that a performer uses to perform specific tasks, such as grade book programs , electronic notebooks, spreadsheets, statistical analysis packages, and even e-mail programs and Web browsers.

Reigeluth states that the Human-Computer-Interface (HCI) aspect of EPSS covers all these components and can be thought of as an umbrella under which all of the other components are located.

What Makes EPSS Different?

As stated in the previous pages, it is generally agreed among EPSS experts that an EPSS is different from an instructional system (IS) in many respects. One of the most important differences is its main focus, which is performing rather than learning. In their article, Witt and Wager (1994) compare EPSSs with instructional systems to highlight the differences between them. They argue that an instructional system is "a product that contributes to the achievement of some type of learning outcome," and instruction has methods "for bringing about desired changes in student knowledge and skills for a specific course content and a specific student population" (p. 20). In contrast, "while learning may occur during the use of electronic performance support, its primary purpose is to facilitate performance of a task; learning is of secondary importance" (p. 20).

The second important difference between IS and EPSS is using EPSS while doing the actual job, not beforehand. On this aspect, Cole et al. (1997) state that EPSS is actually a paradigm shift for training organizations because in EPSS "knowledge delivery takes place soon enough that is applied to the appropriate situation, and late enough that the user does not have to go through training or information overload" (p. 50).

The third difference reported is that people do not need to follow a predetermined sequence while using the EPSS. A novice and an expert may use it differently. In addition to this, in an instructional system it is assumed that the terminal requirements of an instructional product are predetermined (Witt & Wager, 1994). According to Ryder and Wilson (1996), if the content is well-defined and stable, and it is based on algorithms and rules, an instructional system becomes the best solution. However, an EPSS provides contextually relevant information for a dynamic environment (Laffey, 1995).

As seen until this point, even though there are some similarities between Instructional Systems and EPSSs, the differences are important. For certain kinds of well-defined content within stable training environments, instructional systems may work satisfactorily. However, as stated by Wilson, Jonassen, and Cole (1993), the limitations of this approach become apparent when working in ill-defined content domains, which requires self-pacing and creativity or when working with highly diverse populations.

Need for an EPSS Design/Development Approach

As seen in the previous section, EPSSs are significantly different from instructional systems. Therefore, as stated by Witt and Wager (1994), the fundamental differences of purpose between the two products indicate that different methodologies need to be used to create them. Laffey (1995) emphasized that EPSSs will no longer be simply extensions of what we know about instructional design and the design of databases. The same point is made by Gustafson (2000) that the design of EPSSs requires alternative (or mixed) methods. Finally, the lack of well-established design models is obvious from the literature. For example, Gery (1995) states,

> Few [EPSSs] are guided by a set of integrated and fully articulated design principles. Many innovations are the result of individual or team creativity and iterative design employing rapid prototyping coupled with ongoing usability and performance testing (p. 48)

Current Approaches to EPSS Design/Development and Their Problems

There is a broad consensus that there is a lack of well-defined EPSS design and development models (Gustafson, 1993; Gustafson, 2000; Milheim, 1997; Laffey, 1995; Rosenberg, Coscarelli & Hutchison, 1999), and information that describes how people have actually designed and developed EPSSs is also insufficient (Gery, 1989b). As stated by Dickelman (1996) even though the definition of EPSS is clear for many people, they cannot tell you "how to go about doing it".

According to Gustafson (2000), there are three main reasons for this lack of information. First, since many EPSSs are developed by commercial organizations and are their property, they do not share this information with others. Winer et al. (1999) also support this argument. They state that because of competitive advantage and strict confidentiality regulations, it is difficult to obtain data about specific EPSS developments. Second, the history of EPSS is no more than 10-12 years. Therefore, procedures have not been well developed and tested. Gery (1995a) supports the view that since EPSS is relatively new, it is difficult to define a detailed development methodology for EPSS. Finally, Gustafson reports the third reason, as ".. some EPSS designers may be reluctant to talk about what they have done, since they are unable to clearly articulate specific and replicable procedures." (p. 42).

In the literature, EPSS designers have used classical instructional design approaches (e.g. ADDIE) (Benko & Webster, 1997; Graham & Sheu, 2000), a modification of ED^4 (an instructional design and development methodology from Digital Equipment Corporation) (Brown, 1996), rapid prototyping (Tripp & Bichelmeyer, 1990; Law, Okey & Carter, 1995), prototyping and layers of necessity (Wedman & Tessmer, 1991; Northrup et al., 1998), or combination of them (Gustafson, 2000). Witt and Wager (1994) report that large companies modify the ISD models "to meet the unique challenges and complexities of EPSS solutions." (p. 20)

However, as stated by several researchers (Wilson, 1999; Rosenberg, Coscarelli & Hutchison, 1999), ID models have several limitations in performance support systems development. The most significant problem with them is that they generally analyze the job tasks to identify whether someone can perform the task or not. Performance support is concerned with providing information and assistance when the employee needs it and how they need it (Witt & Wager, 1994). Rosenberg et al. (1999) report the necessity of a paradigm change to performance technology systems development models.

Habelow (2000) also raises the issue of the difference between the EPSS design process and ISD, and she discusses the need for involvement of other disciplines. She states

> … most organizations have their own customized version of an ISD process that is used as an approach to the design of EPSS applications. With such a striking difference in perspective, learning versus performance, a new model of EPSS design and development that combines the instructional value of education focused models and incorporates a more technological perspective of computer and information systems models may be warranted. (p.76)

Raybould (1995) suggests that the methodology for developing this electronic infrastructure must have a wider scope than other existing methodologies. He emphasizes the need for involving different elements in EPSS design methodology, namely human performance technology, instructional systems development, computer based training, information engineering, business process reengineering, knowledge engineering and technical writing and interface design (Raybould, 1995; Raybould, 2000).

Help from Other Fields

As stated above, an EPSS is composed of several modules or components. The implementation process needs to be based on multiple theories and approaches. Therefore, the process of building those components in an integrated manner has to be a multidisciplinary approach. Raybould (2000) calls this approach Performance Support Engineering (PSE).

For a successful EPSS design/development process, Hannafin, Hill and McCarthy (2000) emphasize the importance of welcoming other approaches that emerged outside of our traditional community, in other related disciplines. Similar to other researchers, they also agree on the multidisciplinary nature of EPSS design, stating that:

> EPSS design practices represent a convergence among several related fields and specialties, including human performance technology, computer-supported collaborative work, technical communications, electronic publishing, instructional design, and workplace training. (p. 3)

Similarly, Gustafson (2000) affirms this view and argues that EPSS design/development is an immature technology, so exploring other disciplines and applying their related methodologies will definitely make a significant contribution to the work in EPSS design/development.

It is obvious that EPSS design and development is a complex and multidisciplinary process. Among the several methodological approaches that I have found in the literature, there are two approaches that look very promising for building a model for the EPSS design and development process. Multiview is one of them, which comes from Information Science, one of the Soft System Methodologies (SSM). The second one is Chaos Theory, which is related to SSM and ISD. Since the EPSS design and development process is so complex, Chaos Theory might provide us with a new perspective to better understand this process. It is this researcher's initial intuition that an EPSS has similar characteristics to a chaos system.

Information Systems Design and EPSS

According to Villachica and Stone (1999), Information Systems (IS) development models offer detailed strategies that can be applied to EPSS creation. Cole et al. (1997) also agree on this view and argue that EPSSs should adhere to general software engineering methods. Furthermore, Gustafson (2000a) strongly encourages the researchers in IST to look more at approaches in Information Science discipline. Foshay et al. (1999) capture the essence of building human performance theory from IS by stating that IS principles "define a common ground between HPT [Human Performance Technology] and information science" (p. 899). According to them three branches of IS support HPT: Information Technology, Information Systems and Information Management.

Complex projects and unsuccessful attempts to realize them is a common problem for many disciplines/fields. Recently, a systemic approach to this kind of problem-solving has been provided in a methodology developed by Peter Checkland, Professor of Systems at Lancaster University, UK. This is known as the Soft Systems Methodology (SSM) (Checkland & Scholes, 1990). It was developed to overcome the limitations of the conventional systems analysis approaches. Such approaches are prescriptive and emphasize the "hard" aspects of the problem domain, which is the certain and the precise. However, Soft Systems Methodology is designed to allow the human element of such systems to be incorporated into system design work, and both technical and non-technical issues are explicitly addressed. It is most appropriate for systems that are complex and ill-structured (Finegan, 1994; Bennetts & Wood-Harper, 2000).

A well-known design framework from IS, which seems a promising approach for building an EPSS design/development model, is Multiview (Avison, 1996). Multiview contrasts with traditional IS design methodologies, where "the steps are prescribed in great detail and are expected to be followed rigorously in all situations" (Avison & Wood-Harper, 1990, p.13). Multiview is perhaps the most famous attempt at combining hard systems and soft systems philosophies.

As stated by Raybould (2000), a very important aspect of performance support engineering is its focus on human elements as well as computer elements. Therefore, I believe several aspects of Multiview, specifically SSM and STD, will best fit for the development of an EPSS design model.

From my practical experiences, both in IS and ISD, I see that traditional development methods are only used in theory. As stated by Raccoon (1995a), the practical development of such systems has always followed complex life cycles. Rather than phases being followed rigidly, they come and go as the project evolves. This is the same pattern that nature follows. The weather, political systems, economy, society and all other complex systems do not follow a predetermined path. Rather, they show a chaotic path. Therefore, I believe that, while exploring the EPSS design and development process, it is worthwhile looking at Chaos Theory. In the following section, this approach will be explored briefly.

Chaos Theory (Dynamic Systems or Adaptive Development)

Several researchers agree that the traditional systems approach to problem solving has a reductionist nature and it tends to solve a problem by fragmentation, one stage at a time (Finegan, 1994; You, 1993; Jonassen, 1990). This approach may work for some small scale and well-defined situations. However, the systems associated with human activity are complex and not well-defined. According to Jonassen (1990) "simple systems behave in simple ways, and complex systems behave in complex and less predictive ways. The behavior of a system cannot be examined accurately by analyzing its components" (p. 34). As an alternative to a linear, reductionist and deterministic approach, Chaos or the dynamical systems approach is proposed. In a complex system "the components are related and interlock with one another such that a change in one component invariably affects another part of the system, or eventually even the entire system" (Murnare, cited in Chieuw, 1991, p.25). Gordon and Greenspan explain Chaos as the study of disorder, and it appears in non-linear systems (as cited in King, 1991). Since Chaos deals with non-linear and disorderly systems, many disciplines, including technological, social and economic, are appropriate for applying its principles. As stated by Highsmith (2000) "from physics to biology to chemistry to evolution, complex adaptive systems theory began to help explain occurrences in the real world that the linear approximations of the old science could not" (p. 10). According to King (1991), for many different disciplines, Chaos gives new data, suggests innovative approaches to old ideas, and reaffirms certain approaches.

As pointed out by Hannafin, Hill and McCarthy (2000), "EPSS systems have evolved into larger and more complex environments" (p. 32). They do not have fixed features and components. In addition to this, especially in complex domains, "an effective performance requires expertise beyond the skill level" (Sinitsa, 2000, p.18) and performers follow unpredictable patterns that are discontinuous and complex (Paulson & Paulson, cited in You, 1993, p. 24). As a result, such factors make the design process itself less systematic and more situated (Sherry & Wilson, 1996). EPSS development does not operate in isolation, and not done in a linear manner (Ho & Hara, 2001). However, this life cycle is interdependent and connected.

To summarize, the EPSS design/development process has a complex nature. To the extent that it is similar to IS development, EPSS development is at the edge of technology, and it requires a mixture of chaos-based top-down and bottom-up processes (Raccoon, 1995b).

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Categorizing Exemplary Educational Websites

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Abstract

The number of educational sites on the World Wide Web grows daily and teachers may have difficulty identifying sites well matched to their intended outcomes for learners. This study describes the development of an instrument to categorize educational Websites. One hundred ninety-five (195) "exemplary" or award-winning educational Websites were examined and evaluated by the researchers. During the evaluation, thirteen general site categories emerged, and the sites were sorted into these categories. This paper describes the categories of the instrument, the process by which the instrument was developed, and the result of this categorization.

The use of the World Wide Web (the Web) appears to be increasing rapidly in education, and may have already become an important resource for teaching and learning. However, the sheer number of educational sites and variety of sources can be overwhelming for educators who want to incorporate the Web in instruction. It is difficult to know which sites are good and which are not. In fact, this proliferation and the speed with which new sites appear makes it near impossible for any one teacher to examine enough sites to sift the wheat from the chaff.

To assist teachers and parents, some organizations and agencies have recognized educational sites they judge to be "exemplary." For example, the International Academy of Digital Arts and Sciences selects the best of the Web for the annual Webby Awards (http://www.webbyawards.com/nominees/index.html). Similarly, each year the Education Source names their Top 100 Educational Websites (http://www.edusource.com/articles/top100_99/default.asp). PC Magazine also names its annual Top 100 Websites, including an "Education and Family" category (http://www.zdnet.com/pcmag/stories/reviews/0,6755,2394453,00.html). Some agencies identify "exemplary" Websites more often; for example, each month the Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) recognizes thirteen exemplary Websites in science and mathematics (http://www.enc.org/classroom/dd/nf_ddcrit.htm).

Examining these recognized educational Websites reveals a wide variety of purposes, strategies, audiences, and content. Our purpose in this study was to examine such recognized educational Websites and develop an instrument to categorize them based on emergent categories. This, in turn, should help show which types of sites seem most likely to be named as "exemplary."

Methods

A total of 218 sites were compiled from sites recognized in 2000 by the above-named recognizing groups (Webby's, ENC, Top 100 Ed Websites, PC Magazine). When we examined those sites, seven were duplicates and sixteen were non-functional, yielding 195 functional "exemplary" educational sites.

The 195 sites examined were developed for various purposes and were diverse in target audience and content. This meant that any instrument we designed had to encompass what we found on the sites. Beginning with a proposed categorization instrument, two researchers reviewed and categorized each of the 195 sites. They then compared results, and discussed and debated at length on sites they categorized. A third researcher served as a mediator to resolve inter-rater differences. Each site was analyzed until all three members agreed on the categorization of every site. The instrument and operational definition of each category evolved during the process of evaluating the sites. That is, as we analyzed the sites and resolved our disagreements, the categories on our instrument were modified or confirmed.

Below we list 13 possible categories for Websites that emerged as the researchers evaluated the sample of "exemplary" or award-winning sites. Note, however, that not all sites can easily be placed in a single category. Some sites exhibit properties of two or more of the following categories. When classifying these sites, we identified which classification seemed most representative of the site as a whole. Sites that were equally distributed across two or more types were noted and included in the discussion of results. The categories are presented as follows with definitions and examples of each

Instructional

To be classified as instructional, a site must include (1) an intended learning outcome, (2) instructional strategies, (3) learning materials and activities, and may include (4) learner assessment and/or feedback. An instructional strategy is a pedagogical technique designed to facilitate learning through a combination of teacher and learner activity. We observed that these elements may be explicitly stated and demonstrated or they may be embedded within site content.

Instructional Websites with a constructivist-oriented design and/or self-exploratory navigation strategy usually don't include formal stated learning tasks, however. Instead, these sites usually provide learning activities that require learners to do something on the Web, including reading posted information; completing practice activities and/or playing games; exploring related resources; using a site search engine; communicating and/or sharing with peers, teachers, and/or experts; exploring, articulating, or reflecting in a problem-based learning; and creating content. Note that the learning activities in a site must go beyond just reading posted information in order to be categorized as an instructional site.

Examples of instructional sites include: *Learn Physics Today* (http://library.advanced.org/10796) and *Conflict Yellowstone Wolves* (http://powayusd.sdcoe.k12.ca.us/mtr/ConflictYellowstoneWolf.htm). *Learn Physics Today* is an online physics tutorial. *Conflict Yellowstone Wolves* require learners to analyze the Rocky Mountain Gray Wolf problem and draw their own conclusion to the question: Should the wolves in Yellowstone National Park be removed?

Sometimes a site will appear to be instructional when it is not. For example, some sites provide online quizzes and games (one form of learning activity). However, their mere presence does not guarantee that a site is instructional. When quizzes and games serve no instructional purpose and are designed primarily for entertainment, we did not classify the site as instructional. Another way in which a site can erroneously appear to be instructional is when it uses instructional labels like "tutorial" or "problem-based learning project" in referring to itself, but actually contains no instructional strategies. In other words, it is not enough simply to claim to be instructional. The key is whether the site includes the three essential instructional elements.

Content Collection

A content collection site is a collection of information about a specific content area (such as genetics or insects) that is informative and might be used in learning but is not instructional. Content collection sites differ from instructional sites in that they don't provide users with learning activities, goals, strategies, or assessment. They may, however, include informative readings, illustrations and other rich content. A typical content collection site on a specific subject is *Common Cold* (http://www.commoncold.org/), a comprehensive source of information about the common cold. *Carol Hurst's Children's Literature Site* (http://www.carolhurst.com/) is an example of content collection site on a general topic. The site is a collection of reviews of great books for kids, ideas of ways to use them in the classroom and collections of books and activities about particular subjects, curricular areas, and professional topics.

Archive/Database/Reference

An Archive/Database/Reference (ADR) is a collection of information that is organized as an archive. These sites may be indexed chronologically, alphabetically, or topically. Such sites are designed as information and reference tools. Online dictionaries, encyclopedias, reference books, and question-answer services comprise this category. These differ from Content Collections in that they may address multiple topics and are oriented toward searching for information rather than examining a topic. One example of an ADR sites is *American Memory* (http://memory.loc.gov), a site that offers more than seven million digital items from more than 100 historical collections relating to the history and culture of the United States. *Ask Jeeves for Kids* (http://www.ajkids.com/) and *The Last Word Science Questions and Answers* (http://www.last-word.com/) are representative of questions-answers service ADR sites.

Compilation of Online Learning Activities/Games

These sites are collections of individual learning activities and/or games to be completed online by learners. *ExploreMath.com* (http://www.exploremath.com/index.cfm) is a collection of interactive math activities in 13 categories. As suggested by the site, these individual learning activities may be incorporated into the mathematics classroom, lab, or distance learning curricula, but such compilations fail to exhibit the essential three components of an instructional site.

Collection of Links

Sites in this category feature listings of categorized external hyperlinks to online resources on a subject. They contain little or no content of their own and serve principally as portals to external content. European Renaissance (http://www.execpc.com/~dboals/rena.html) lists 67 related external links. It should be noted that if a site's collection of links are mostly internal (or most of the actual content is within the site), it should be classified as Content Collection.

Online Exhibit

Online exhibits are focused collections of media (for example, images, recordings, animations, videos, VRMLs) related to some particular content or event. Displays of museum or organization holdings online are typical of this category. Such sites are designed for exhibition and information purposes. These virtual exhibits are often representations of actual museum exhibits in the physical world. For example, *Ocean Planet* (http://seawifs.gsfc.nasa.gov/ocean_planet.htm) is an online version of than actual exhibit from the Smithsonian National Museum of Natural History.

Teacher Resource

Teacher resource sites are designed to provide teachers with such things as lesson plans, classroom activities, teacher guides, curricula, state and national standards, and professional-development resources. These materials may be housed within the site or available as downloadable files. While such sites may also include subject matter links and learner activities, the main focus of the site is assisting teachers.

For example, *One Sky Many Voices* (http://www.onesky.umich.edu/) lists inquiry-based K-12 science curricula for use by teachers, and *Illuminations* (http://illuminations.nctm.org/) is designed as a teacher resource with the following components: online multimedia math investigations, classroom video vignettes, standards-based lesson plans, links to reviewed Websites, and access to the National Council of Teachers of Mathematics Principles and Standards.

Vicarious Participation

Vicarious participation sites provide learners with opportunities to participate online in an ongoing educational or research activity, or an expedition. Virtual field trips are included in this classification. These sites attempt to give the learner a sense of participation in activities not available to the typical classroom student. Such sites may archive the materials from past explorations for examination any time after the activity is concluded. *The Jason Project* (http://www.jasonproject.org/) is an examp le of an ongoing educational activity. In *The Jason Project*, learners can participate in a current learning adventure and visit Jason's past expeditions. In *Extreme 2000* (http://www.ocean.udel.edu/deepsea/), a deep-sea research expedition, learners may view video clips of the expedition, read the dive log and daily journal, and listen to live audio from the research team.

Research/Curriculum Project

These sites are designed to inform the visitor about a particular ongoing research or curriculum project. Content may include news and upcoming events, research results and publications, individuals associated with the project, funding, and other related information. For example, Rural and Urban Images (http://www.ael.org/nsf/voices/index.htm) is a three-year project seeking to help girls excel and feel confident in science, math, and technology.

Communication Community

Communication community sites facilitate discussion, interaction, entertainment, and other information-sharing. Users can play interactive games and share thoughts and ideas with each other via e-mail, chat, and message boards. Such sites usually do not include learning activities, although they may be "educational" in the broader sense of encouraging discussion of current events and issues of importance to learners. Example sites include *Cyberkids* (http://www.cyberkids.com/) and *Kids Space* (http://www.kids-space.org/).

Place with Public Mission

This Website classification refers to actual places such as museums, historic sites (like Mystic Seaport or Colonial Williamsburg), zoos, gardens, aquariums, parks, and the like. Such sites typically address visitor information, schedules, exhibits, "how to get here," membership, and special events. Many of these sites include an education section with learning materials and activities for teachers and students and are often referred to under the umbrella of Informal Education. *Exploratorium* (http://www.exploratorium.edu/index.html) and *Colonial Williamsburg* (http://www.history.org) are two examples of such sites.

Academic or Research Organization

These sites represent a particular non-commercial research organization or academic unit. They typically address such things as the nature and purpose of the organization, purpose, its current and past projects, recent results, pertinent news and events, and related educational materials and activities. *NASA* (http://www.nasa.gov/) and the *NASA Jet Propulsion Laboratory* (http://www.jpl.nasa.gov) are two examples of such sites.

Commercial

Commercial sites are primarily intended to promote and sell products or services. Many commercial sites have ancillary components designed to inform, educate, or entertain. For example, a company selling cold and flu medicine may include information or instruction about the causes and treatments of colds and flu. It is sometimes necessary to explore a site extensively to identify whether it is commercial or not. Simply having commercial sponsorship (as might be indicated by advertising banners) is not enough. The site must have a goal of helping to promote a company's products. One way in which some commercial sites promote their products or services subtly is by targeting young audiences using cartoon-like animation and games on their Websites. Once again, one needs to look for the commercial connection. Usually it becomes clear on close examination. Examples include *CNN Interactive* (http://www.cnn.com), *National Geographic Society* (http://www.nationalgeographic.com/), *SurfMonkey Kids Channel* (http://www.surfmonkey.com/) and *US Space Camp* (http://www.spacecamp.com).

Table 1 presents the distribution of "exemplary" sites across our classification scheme. The three categories most likely to be recognized, in order of distribution in our study, were Content Collection (26.2%), Instructional (20.5%), and Teacher Resource (11.8%). These three types of sites account for approximately six out of every ten sites recognized. This suggests how the recognizing groups defined "exemplary" and perhaps hints more directly at how they viewed educational use of the Web.

Table 1. Distribution of "Exemplary" Educational Websites Across Categories

Categories	**# of Sites**	%
Instructional	40	20.5%
Content collection	51	26.2%
Archive/Database/Reference	14	7.2%
Compilation of individual online learning activities/games	13	6.2%
Collection of links	13	6.2%
Online exhibit	7	3.6%
Teacher resource	23	11.8%
Vicarious participation	9	4.6%
Research/Curriculum project	2	1.0%
Communication community	2	1.0%
Places with public mission	11	5.6%
Academic or research organization	6	3.1%
Commercial	10	5.1%
Total:	195	100%

Conclusions

We learned quickly that some sites cannot be neatly classified into a single category. We analyzed sites that could be assigned to two, three, or more categories. In dealing with such sites, we chose to make a holistic assignment based on what we deemed to be the site's principal orientation in terms of our classification scheme. For example, *NASA Is My Playground* (http://kids.msfc.nasa.gov/) and *Merriam-Webster Word Central* (http://www.wordcentral.com) contain both instruction and teacher resources. Since the majority of content was instruction, the sites were categorized as instructional sites. *Ask Jeeves for Kids* (http://www.ajkids.com) fits into at least three categories – ADR, Teacher Resource, and Communication Community. Since its primary activity was searching, it was classified as an ADR site.

Although Reeves and Reeves (1998) and Wilson (1997) have suggested that constructivist design may be promising in Web-based learning environment, the "exemplary" sites examined in this study were almost exclusively objectivist in design orientation. Our results are consistent with those in a similar study conducted by Mioduser, Nachmias, Lahav, and Oren in 1998. Their study investigated 436 educational Websites in an effort to determine the current state and emerging trend in Web-based learning environment.

We found a number of Websites that perhaps overstated the extent to which they were instructional sites. For example, *Embryo Images* (http://www.med.unc.edu/embryo images/) described itself as an instructional tutorial, but is simply is a slide show of images with text descriptions. Other sites included descriptions of "exploration" or "problem-based" instructional strategies, but turned out to involve nothing more than reading posted information.

The next step in our research will be to complete an analysis of the instructional design of the 40 instructional sites we identified. Our goal is to determine the major common characteristics of such recognized instructional Websites. As part of this analysis, we plan to refine and expand our current instrument's categories.

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PreK Central: "Come and Play"

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Abstract

PreKCentral is a web site designed to provide preschool teachers, daycare providers and families with tools to be used for the positive stimulation, development and education of young children through the available technology. This web site uses a database to hold the activities and links and web site visitors use either a predefined simple search or tailor the search for their interests. This session would provide an overview of the development of the site, the design considerations/constraints, and an overall look at the site. Other features such as a chat room, forum, kid art and links will be examined.

Description of the site

PreK Central is a web site designed for preschool teachers, parents of preschoolers, and caregivers. This site is based on the mission, philosophy and practices of the National Association of Education of the Young Child (NAEYC). NAEYC supports the planning and practice of guiding preschool children with activities that are developmentally age appropriate By focusing on the needs of the child, NAEYC believes children begin to build a strong foundation to lifelong learning. The NAEYC web site can be accessed at http://www.naeyc.org.

PreK Central strives to provide many services to its visitors. Site visitors can search for age appropriate activities as well as participate in chats, forums, find outside links to other sites or explore our preschool art gallery. Early in the planning stages of the site, it was apparent that an underlying database was needed to provide a dynamic site incorporating structure, organization and to anticipate site growth. Each section of this site was designed with organization, content, usability and potential site growth in mind.

The development of the PreK Central (PreK) web site began in 1997 after the collaboration on two web sites. As graduate students we redesigned the web site for college of Human Resources and Education at Virginia Tech and were instructional designers for PE Central (http://pe.central.vt.edu.) As parents of preschoolers, we both found few sites geared toward preschool education and even fewer that offered developmentally appropriate activities for children. As instructional designers, we found that many very good sites were available on the Net, but they lacked three key elements: organization /content, a scheme for age appropriateness and appropriate use of technology. Sites from the search lacked the organization and content needed to support the site visitor. Also missing from preschool education sites was a scheme to determine an activity's appropriateness for preschoolers. Another missing component from available sites was the appropriate and effective use of available technology. These three areas were the main focus in our site design and will be elaborated on through the site's design process.

Planning and constructing the site

Organization and content

Pre K Central was envisioned with these multiple sections: a database of activities, a chat room, a forum, a page of preschooler-related links, and the preschool art gallery. Access to these sections is designed with the audience in mind. The elements that make up the site (the navigation, layout, graphics, links and other information) should be easily understandable by any visitor to the site. Our target audience is a diverse group of visitors. The site is for teachers, parents of preschoolers and other preschool caregivers. This audience can be broken into two major groups: those who have formal training (i.e. preschool teachers) and those with no formal training. Sites with a diverse audience such as PreK Central need to be flexible and provide several avenues to obtain information. One way to design to these audiences is to begin by asking questions like, "How will different visitors use the site?" or "What information will visitors be looking for?" This technique becomes one of the driving forces in the design of the site. A detail of how those with formal training and those with informal training are addressed in our scheme for appropriate practices.

Site Content

The database would need to hold blocks of text, but could also be used for other forms of web media such as images (GIFs and JPEGs), sound files (MPEGs, WAV files or QuickTime movies). There is also a need to try to foresee other forms of media that may be included since web design is still in its infancy. Designers for PE Central failed to accurately predict how the site would grow. By planning for growth, hopefully Pre K Central could easily be expanded to site visitor's future needs.

After designing the database , usability testing was done by a technique we termed a 'mental walkthrough' which was a helpful tool to determine whether the logic used in the design process was sound. This also helps later when deciding whether of not to use certain elements. "Mental-walkthroughs" put designers in place of the site visitor and mentally walk through a web site. These mental walkthroughs help us, as designers, add consistency to the site. They also force designers to " think outside of the box" and really consider the site visitor. Many times web designers design a site as they would use it and force the visitor to "think like me" to get an around a site.

Some questions asked for this site (with our possible solutions):

What information might I look for if I was a parent?
- Activities grouped in understandable categories
- Variety of outside links

What information might I look for if I was a teacher?
- Activities grouped by skills to build
- Variety of outside links

Is the viewer and potential viewer being considered?
- Assume the role of a potential viewer

Is an experienced visitor bored or annoyed by the searches?
- Build with enough search options
- Layout the search page so that it is easy to navigate
- Layout the site so the search is easy to find

Could I use this site if I had little experience using the Web?
- Design easy, obvious site navigation
- Provide many ways to find information

What terms are common enough for a layperson such as a parent to recognize?
- Choose terms that are intuitive as to their meaning
- Use images that help describe terms

What terms would a teacher or trained educator likely to recognize?
- Use NAEYC's terminology

How could both these groups of visitors get to the same information, easily and quickly?
- Provide many ways to find information

Scheme for appropriate practices

PreK Central has a diverse audience: for preschool teachers, parents of preschoolers, and caregivers. As state before, the audience is made up of two major groups: those who have formal training (i.e. preschool teachers) and those with no formal training. Searching for information was a crucial part of the design of the PreK Central web site. On the surface there appears to be categories of activities and a searchable feature. These are really one the same search. The categories of activities are really defined fields in the database, a narrowed search.

Creating two different ways to search the same database solved the solution to this. For teachers and other child care professionals, a search of "kid skills" is offered. From NAEYC's standards of appropriate practices (Bredekamp, 1987) four categories of skills emerged. Named: Physical, Cognitive, Social and Emotional Skills, these "kids skills" are a set of skills that teachers would most likely be using to plan their activities. Here is the complete listing of our Kid Skills and the concept they introduce:

Kid Skill	**Introduces...**	**Kid Skill**	**Introduces...**
Physical	large motor	Cognitive	imagination
	small motor		formulating hypothesis
	levels of activity		ordering
	hand-eye coordination		critical thinking
			levels of complexity
Social	communication with others		addition /subtraction

social awareness
social interaction levels
social leader or follower
social cooperation
large groups
small groups
multicultural
repertoire for solving social
problems

Emotional

expressing needs/feelings in
appropriately
self-control
perseverance
patience
orientation of self in world
concepts of self

classification
seriation
number
spatial relationships
mass and quantity
causality
time concepts
spoken language
written language
divergent thinking
size of objects
balance and support of
structures
space concepts
(volume/area) relationships
of objects
observations
creative thinking
creative expression

Table 1: Kid Skills and concepts introduced.

For parents or others looking for appropriate activities a search of "kid talents" or categories that activities naturally fall into is possible. Kid talents are topics such as "Make believe" and "Arts-n-crafts". These Kid Talents are matched to images that depict the kid talent. Here is our listing of Kid Talents with our description of what kind of activity falls into that Kid Talent.

Talents	Definition
Arts-n-crafts	Foster creativity through 2&3D art
Make Believe	Encourage imaginative play
Got Rhythm?	Introduce body movements & music
Word Play	Whole word, letter recognition, phonics
On the move	Gross motor skills
Easy as 1, 2, 3	Build math skills
Celebrate Us!	Exploration of own and other cultures, holidays and customs
Me Too!	Activities with several generations
Hands-On	Manipulative and small motor
I Wonder	Science activities
Clubhouse	Circle time, social activities
Young Explorers	Exploration outside the four walls of a classroom

Table 2: Kid Talents and their objective.

Site Organization

The site is broken into several components that support the site visitor. These components are the database of activities, a chat room, a forum, a page to related outside links and a gallery of children's art. Each of these supports the visitor in different ways. The activities are the most important part of the site. This section will hopefully grab the visitor's attention and bring them back. The chat room and forum and still in their developmental stages. They are intended to begin on line discussion among teachers, parents and caregivers. The chat is a place where all can gather to trade information and ideas in real time. The forum differs in that is more of a posting or bulletin board for discussion. Presently there are just topic listed, but it is hoped that eventually guest speakers and experts in the field of childcare and early childhood education can post their points of view. There will be available along with the opportunity for others to respond. The off site links is a collection of early childhood education links. Many topics are available from funding opportunities for preschool and preschool teachers to child advocacy links.

Overhaul of this section is being done to include a search similar to the activity search. The last section of preschool art is a fun and playful way preschools; their teachers and even parents can show off and learn from preschool art.

Appropriate, effective use of available technology

Appropriate and effective use of the available technology has always been one of our concerns for PreK. Too many times a web site has the potential to be a great site but lacks function or features. This is not a lack of 'spinning and flaming logos' but in the lack of using the technology that is available. An argument may be made that you need commercial software to keep a site up, looking good and running well. We have found the opposite true and have built and maintained PreK Central with very little commercial software.

PreK was created on a "shoestring budget"; Labor was low-cost with two grad students developing in their free time. For most of the site, free "open source" software has been used to bring it online, up and running. Open source software has grown from software developers and users who find commercial software packages too limiting in features, too difficult to modify, leaving them frustrating and difficult to use. It is well maintained, updated and documented, by those who use it. PreK's server runs a free operating system (OS) called RedHat Linux (http://www.redhat.com/). The web server is Apache (http://www.apache.org/), which is also free. The database that holds the activities and links is MySQL (http://www.mysql.com/). Even the scripting language, PHP (http://www.php.net), used to pull from the database is free. The chat and forum software that we use are also open source projects.

Define look & feel

The "look and feel" of this web site was very important. Early in the design process, a childlike theme was chosen for the site. This playful design was meant to encourage even visitors new to the web pages to "come and play". Fitting to the theme, a "childlike handwriting" font and adopting a "crayon colors" color scheme throughout the site. Images for the site were based on simple sketches, drawings and designs created with the help of a two-year-old boy. This became part of the design process and led to color and playfulness as a major theme. This worked well with the subject matter, the navigation and the search method.

From the database and search design, the site had to be easy to navigate, easy to use and easy to find information. With the incorporation of a database, the site could easily be designed with only three or four pages. Search and results pages could be reused, since every search was not a static page. This adds to the consistency of the "look and feel" since visitors become accustomed to seeing one page.

Adding Depth

The next steps to the growth of this web site are to add depth to the site. Plans for this are underway to continue to add more activities, add an easier way for viewers to submit their ideas and to develop the chat room and forum section of the site.

Also in the works is the development of a 'community of users'. The plan is to start locally with local Virginia residents and to spread out to include others in a more virtual community. Hopefully, by adding depth to the Forum to include guest speakers will grow to virtual discussion and seminars. There are also plans to start and widen the collection for viewers to access and educate themselves.

Contacts

You can visit PreK Central at http://prek.dhs.org/ and see our selection of activities. The email address is admin@prek.dhs.org and a listserv at http://prek.dhs.org/mailman/listinfo/prek-announce. This paper can also be downloaded from http://prek.dhs.org/AECT/.

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Improving Visual Recognition Skills with a Digital Image Bank: the medium makes a difference.

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Abstract:

Digital retinal photos were obtained for all first year optometry students at our College of Optometry. The catalog of digital images was utilized in several ways in print and on the web to enhance the development of critical observation and recognition skills needed for examination of the human retina. The use of digital images increased opportunities for practice and feedback resulting in improved performance compared to baseline and to students who had trained previously without using the digital image reference bank.

Problem:

Learning to examine the human retina involves the development of two skill sets: 1) utilizing ophthalmic diagnostic instruments, and 2) interpreting what is observed with them. Training in retinal examination skills (ophthalmoscopy) begins in the first semester of the professional curriculum at the Michigan College of Optometry. A typical entry-level instructional sequence involves lectures on retinal anatomy and features, and on instrumentation and techniques for observation. This is followed by supervised practice in the laboratory. Students examine each other's eyes, observing, identifying and documenting variations in the retinal appearance. Students make judgments with respect to critical features of the retina and have these verified by the instructor. Previously, the rate of progress has been hampered by several factors:

1. Observation time was duplicated because instructors had to examine the retina first before they could comment on the students' observations.
2. Instructors had to spend time looking for specific illustrative examples within the class.
3. Practice opportunities outside of scheduled class time provided no feedback or verification by the instructor.
4. Opportunities to formally assess students' accuracy in observation were limited.

Methods:

The availability of digital ophthalmic photography and web course management software presented a unique opportunity to converge these technologies to enhance training and performance of retinal examination skills.

The first phase of the project involved an analysis of feasibility, methods, materials and cost. An estimate of image acquisition and processing time per subject was determined. Images would be used for both screen viewing and print viewing; therefore, various papers and printer settings were compared for print quality. Estimates of production time and costs for the print versions of the image catalog were determined. Then the images were acquired using the Digivid® retinal video capture system by Helioasis. The software allows the images to be exported in either TIFF or JPEG graphic file formats for utilization outside of the Digivid database. Each of the 68 images was exported and saved in the JPEG format immediately after capture and verification that the captured image was acceptable.

The next phase involved measurement of baseline observational skill level prior to any instruction on ophthalmoscopy and retinal features. First year students were pre-tested via a time-limited, WebCT-delivered and auto-graded visual matching quiz in October of 2000. Ten test images were selected from the acquired image bank and uploaded to the WebCT course. Each of the 10 images was inserted into a short answer question format using WebCT's quiz tool. The student task was to compare each image to a selection of 40 print images assembled and numbered in an accompanying catalog. The student answered by typing in the number of the image they chose as representing an exact match. The question stem advised the student that if a matching image was not found, a response of "0" should be entered. This assured that all 40 images had to be considered before an elimination could be made. A ratio of 10 test images to 40 potential matches and a time limit of 15 minutes were judged to constitute a reasonably rigorous test of pre-instruction observational skills. Questions were presented one at a time, and could not be revisited once answered or skipped.

During the next three weeks, entry-level instruction and practice in the techniques took place. Instruction was enhanced by utilization of the acquired image bank in several ways. Instructors had "key" copies of the class' retinal image catalog printed with the photos identified by name. This enabled quicker awareness of pertinent features of each eye in the class, and more effective guidance of the student's interpretation of his or her observations. This could be done without the instructor duplicating the physical examination process. Furthermore, each student was provided a copy of the class' image catalog printed *without* identifying the photos by name. Similar to the pre-test task, now the students were to compare direct observations of their classmates' retinas to the print images and identify each image by name. In this process, they had to pay close attention to minute details that differentiated similar images from one another. The student received immediate affirming or corrective feedback from the instructor. With much repeated practice, retinal details are identified with greater speed and accuracy. To provide additional practice opportunities outside of scheduled laboratory sessions, the entire class image bank was uploaded to the WebCT course and placed within WebCT's image database tool. These on-line images were identified by name, so that the students could continue their matching exercise by viewing and comparing the screen images to their as yet unidentified print images.

To assess progress from baseline, a time-limited post-test was administered with WebCT in December, 2000. Though the format was the same for this test, previously unseen retinal images were used for all questions and for the printed catalog of potential matches.

In order to compare performance to a control group, the same pre- and post-tests were also administered to second year optometry students, who had trained the prior year without the availability of such an image bank. To assess retention of skill and the impact of this technique, yet another matching test, based on a newly acquired image set, was administered to the experimental group in the Fall of 2001, when they were at the same point in training and experience as their predecessors.

Results:

	Exp. Pre-Test	Exp. Post-test	Control Pre-test	Control Post-test	Exp. Re-test
Date	October, 2000	December, 2000	October, 2000	December, 2000	September, 2001
N	33	34	17	15	26
Mean Score	84.5%	90.9%	85.9%	84.7%	91.2%
s.d.	13.7	11.4	11.8	20.3	13.1
Mean Time	10:05	10:21	8:30	9:46	10:08
s.d.	2:28	2:12	3:00	2:29	2:41

The Wilcoxon signed ranks test was used to determine whether the distribution of the scores differed for several comparisons. Post-test scores of the experimental group showed a significant improvement when compared to their pre-test scores (p=.006). Post-test scores for second year students showed no significant differences from their pre-test scores. The experimental group's third test in September, 2001 showed a significant difference when compared to their pre-test scores of a year prior (p=.020), and no significant difference when compared to their post-test scores of December, 2000. Comparisons included only those students who had completed all tests for their group. The smaller number of scores in the control group did not enable valid inter-group comparisons to be calculated. The WebCT quiz tool enables analysis of time elapsed per question, and time elapsed overall. Though there were measured intra- and inter-group time differences among the several test administrations, none of the time differences were found to be statistically significant.

Discussion:

The results suggest that using the retinal image catalog in print and on the web heightened the experimental group's attention to detail. While it could be argued that familiarity with the test format on the second administration may have improved scores ("learning effect"), this seems discounted by the fact that the control group showed no significant change in their pre- and post-test scores. The retention of improved discrimination skill was confirmed on re-test of the experimental group in September, 2001. Having all the images in a tangible, readily accessible format provided more teaching and learning opportunities. They saw more eyes. They had more practice. The medium improved the efficiency of their learning. We are continuing the process with our current first year class.

Motivation Power: Exciting Kids About Research

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Introduction

Information literacy, the ability to find, select, organize, use, manage, evaluate, and present information, is a critical literacy for the 21st century. In a society dominated (and often overwhelmed) by information in a multitude of formats (e.g. video, audio, text, graphics), a major challenge in education is to teach our nation's youth to "be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information" (American Library Association, 1989, p.1).

To be information literate is to be "an effective user of ideas and information," according to *Information Power: Building Partnerships for Learning*, the professional guidelines for the school library field (AASL/AECT, p. 6). Education goals on both the national and state levels specify the importance of students' ability to use information to solve problems, make decisions and develop skills for lifelong learning.

Information Literacy Models

In the past 15 years, a number of information literacy models have been developed to describe the skills needed to successfully conduct research and solve information problems. For example, Eisenberg and Berkowitz's Big Six© Approach to Information Problem-Solving (1990) specifies a general approach to the information problem solving process consisting of six major steps. The Big Six Approach begins with defining the parameters of the information task or problem and ends with evaluating both the results of the process and the process itself. Stripling and Pitts' Research Process Model (1988) follows a more linear approach to research, a ten-step process interspersed with eight "reflection points" that allow students to evaluate and revise or repeat completed steps where needed.

Kuhlthau's Model of the Search Process (e.g. 1993) uses the results of several years of research to describe the six stages that students undergo during the research process. She found that, rather than a neat and sequential set of skills, it is a learning process that can be somewhat messy and more iterative in nature. She also found that there are both cognitive and affective aspects to the information seeking process. For example, students frequently explore and collect information before they have done an adequate job of formulating and narrowing their topic.

All of these models are useful and share a common framework that we have synthesized into eight major categories of information skills, each with a set of sub-skills, sequenced across three broad research stages (see Fig. 1). The format of this list is not intended to imply a lockstep linear process but, in actuality, represents an iterative process in which any or all skills may be revisited in order to modify or expand on previous ones.

Beginning Stage

Definition

- Identifies requirements of research task.
- Determines amount/type of information needed to complete research task.
- Considers potential topics.

Selection

- Narrows topic to be explored.
- Specifies subtopics or related keywords.

Planning

- Formulates a search strategy.
- Identifies potential information sources.
- Creates a general framework for organizing information found.
- Identifies potential formats for presenting results.

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During Stage

Exploration

- Uses indexes and search engines.
- Locates and accesses information resources.
- Explores range of information resources.
- Rethinks research topic.
- Finalizes formulation of research topic.

Collection

- Selects most appropriate information sources.
- Skims/scans information sources.
- Locates relevant information within selected sources.
- Identifies and extracts relevant information from selected sources.
- Uses highlighting and/or note-taking skills.
- Evaluates quality of information and information source.
- Recognizes when sufficient information has been obtained.
- Stores information for potential future use.

Organization

- Analyzes quality of information.
- Filters out irrelevant information.
- Summarizes/synthesizes/classifies final information.
- Sequences final information.
- Organizes final information for presentation

Ending Stage

Presentation

- Selects most appropriate format for communicating results.
- Assembles organized information for presentation.
- Reviews presentation for grammatical, spelling, and other errors.
- Cites sources appropriately.
- Presents results.

Evaluation

- Evaluates end product.
- Assesses the efficiency of the research process.
- Determines ways to improve future research process and results.
- Determines future usefulness/applicability of research process.

The Power of Motivation

Through her landmark longitudinal research in which she observed students as they completed a research task, Kuhlthau (e.g., 1991, 1993) identified not only the cognitive strategies students used but also the affective feelings that students experienced at various stages in the research process. For example, she found that during the Beginning and During Stages, when students try to identify a research topic and again as they begin to explore and collect information on their topic from information sources, they often experience feelings of anxiety, uncertainty and information overload and are more likely to become discouraged and demonstrate low confidence. She reports that it is not until about midway through the process that students begin to resolve this uncertainty, formulate a more precise research topic and search strategy, and feel more confident and self-determining.

In a study exploring the motivational strategies used by school library media specialists when teaching information literacy skills to students, Small (1999) used the ARCS Model to analyze and describe her findings. She found that while library media specialists incorporated many motivational strategies into their instruction, the majority of those strategies were Attention strategies, with very few Relevance, Confidence, and Satisfaction strategies. Kuhlthau's work, however, indicates a need to emphasize Relevance and Confidence strategies at certain critical points as students proceed through the research process. While current information literacy models do a good job of defining the appropriate concepts and skills to be taught (i.e., describing *what* to teach), they all lack a systematic approach for applying motivational principles to the design of information literacy skills instruction (i.e., prescribing *how* to teach in a way that stimulates intellectual curiosity, encourages continued information seeking, and promotes a desire for lifelong learning and exploration). To help fill this gap, we have developed a way to enhance existing information literacy models with an *overlay* of motivational techniques and strategies.

The Motivation Overlay for Information Skills Instruction (Small & Arnone, 2000) integrates several theories and models in information science and motivation, especially the work of Kuhlthau (e.g., 1993) and Keller (e.g. 1987) to present a framework for designing motivating information literacy skills instruction (see Fig. 2). It is called an overlay because it is meant to be superimposed on any existing information skills model in order to guide the creation or selection of motivational techniques for information skills lessons.

The Motivation Overlay for Information Literacy Instruction promotes an *information motivation* perspective that excites students about information exploration and knowledge discovery and encourages self-determination and self-efficacy in the development of information literacy competence for lifelong learning. "The Motivation Overlay prescribes an SOS (situation-outcomes-strategies) framework for creating challenging, student-centered, information-rich learning environments that (1) take into account the motivational *situation*, including the incoming motivational profile (attitudes and motives) of students, (2) target desired motivational *outcomes*, and (3) suggest broad motivational techniques and specific *strategies* to engage learners in and excite them about the process of constructing meaningful knowledge and developing skills in order to solve authentic information problems" (Small & Arnone, 2000, p. 23).

The Motivation Overlay for Information Skills Instruction specifies motivational goals to guide the design of information literacy skills instruction and selection of motivational techniques and strategies for each of the research stages. Motivational goals differ from instructional goals in that the former describe general feelings, attitudes, and motives to be achieved during instruction while the latter are broad statements to describe the intended learning results of that instruction. Specification of motivational goals is a necessary prerequisite to the selection (and later evaluation) of effective motivational techniques.

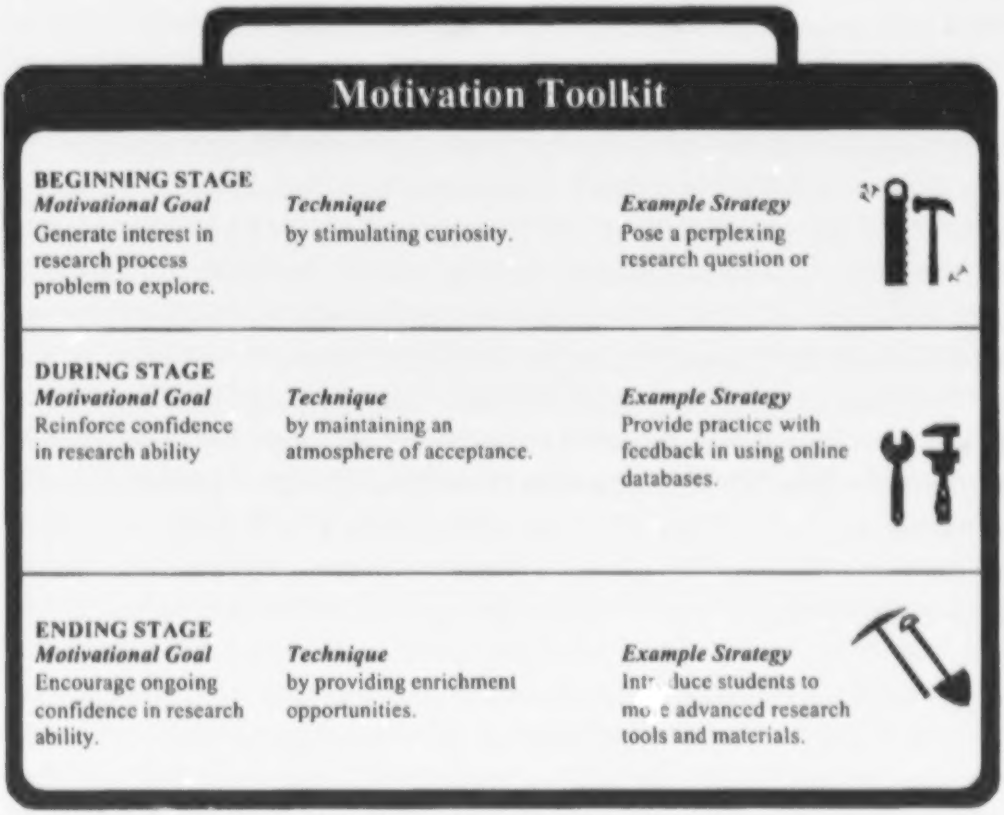
Based on what we know from Kuhlthau's research, at the beginning of the research process when students are required to define their research task, select and narrow their research topic, and plan their research strategy, motivational goals should lead to an instructional design that (1) generates student interest in the research process; (2) helps students recognize the importance of learning information literacy skills; and (3) builds students' confidence in their ability to successfully conduct research tasks. During the research process, as students explore, gather, and organize information, motivational goals should focus on (1) maintaining students' interest in the research process; (2) promoting continued valuing of learning information literacy skills; and (3) reinforcing students' confidence in their research ability. As students proceed through the concluding stage of the process in which their research results must be presented and evaluated, motivational goals should emphasize (1) encouraging students' ongoing confidence in their research ability; (2) promoting students' satisfaction in their research accomplishments; and (3) motivating students' continuing information exploration. The underlying motivation theories for each of these stages are also specified. (For a complete description of these theories and their relation to the Motivation Overlay for Information Skills Instruction, see Small & Arnone, 2000).

Research Stages	**BEGINNING**	**DURING**	**ENDING**
Information Skills	Definition Selection Planning	Exploration Collection Organization	Presentation Evaluation
Motivational Goals	Generate interest in the research process. Establish importance of information skills. Build confidence in research ability.	Maintain interest in the research process. Promote value of information skills. Reinforce confidence in research ability.	Encourage ongoing confidence in research ability. Promote satisfaction in research accomplishments. Motivate continuing information exploration.
Related Motivational Theories	Expectancy-value Need	Expectancy-value Need	Expectancy-value Attribution

	Curiosity Attribution Social learning	Flow Attribution Social learning	Curiosity Social learning

Fig. 2. The Motivation Overlay for Information Skills Instruction

Each of the motivational goals may then be used to guide the design of a "Motivation Toolkit," a set of motivational techniques and strategies for accomplishing a particular goal. One technique and an example strategy for each of the research stages is presented in Figure 3. (For complete toolkits for all three research stages, see Small & Arnone, 2000, pp. 66, 109, and 146).



BEGINNING STAGE ***Motivational Goal*** Generate interest in research process problem to explore.	***Technique*** by stimulating curiosity.	***Example Strategy*** Pose a perplexing research question or
DURING STAGE ***Motivational Goal*** Reinforce confidence in research ability	***Technique*** by maintaining an atmosphere of acceptance.	***Example Strategy*** Provide practice with feedback in using online databases.
ENDING STAGE ***Motivational Goal*** Encourage ongoing confidence in research ability.	***Technique*** by providing enrichment opportunities.	***Example Strategy*** Introduce students to more advanced research tools and materials.

Fig. 3. Example of a Motivation Toolkit (adapted from Moyer & Small, 2001).

Each Motivation Toolkit can be customized to meet the motivational needs of a particular lesson. In addition, each Toolkit can be expanded and updated over time. The creation and use of Motivation Toolkits will enhance the teaching and learning of information literacy skills for all students.

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Issues In Integrating Computers Into Classroom

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Abstract

The technology adaptation is a very complex process. This process includes many different components or variables such as quality of technology teacher training, quality of hardware and software, strategies and alternative ways of infusing software into lessons and effectiveness of class organization (District of Columbia, 1992). In this paper, I will discuss computers and computer-related issues in the classroom. This paper specifically focuses on the following issues:

- *How technology/computers is integrated in the classroom*
- *How it changes teachers' classroom practices*
- *What determines students' attitudes toward technology*

Computer Integration

Computers have been in schools for a long time. While some teachers have integrated them into the curriculum successfully, some others have not used it at all. The following three issues can be considered important in integrating computers in the classroom: what roles do computers play in classroom? To what extent do teachers employ them to teach? And what are the specific procures and models followed to integrate computers in the classroom?

Roles of Computers in the Classroom

Computers have different roles and functions in the classroom. Seven major uses of computers in education have been discussed in the literature: drill-and-practice, tutorial, problem solving, simulation, inquiry, testing and programming. In the drill-and-practice, students are introduced new concepts and skills, and then computer gives practice in using them. A Spanish teacher, for example, may spend one lesson explaining the use of the imperfect tense, and for the next lesson may design a computerized practice in handling this tense.

In the tutorial, computer introduces and explains concepts and skills in which it gives practices. Similar to the programmed instructional text and teaching machines, the tutorial presents informational frames and also asks questions about them. In the problem solving, students are expected to solve problems posed by the computer. The computer structures the problems in a way that students identify the solution step by step and at the end of each successful step the computer provides scheduled rewards. Students' behaviors are shaped towards thinking about and tackling with problem solving.

In the simulation, students confront an environment that [illegible]rates under certain rules. Their role is to act within this environment and then observe the results. For example, in a geography course, students can create their own trip across the Atlantic and make adjustments along the way accounting changes in wind and currents. Students also may use computers to retrieve information from diskettes, CDs, remote data sources to reach information from books and periodicals or the product of electronic publications that appear in no other form. The most common application of the computers' inquiry function would be searching the World Wide Web pages to gather data to solve a problem.

Computers are also ideal for presenting and scoring tests. They can automatically adjust the difficulty levels of test items based on students' responses so that students' performances are measured more precisely in less time. On the other hand, computers are able to improve students' learning performance by providing instant feedback based on students' answers. Computers are programmable tools. There are sets of instructions written one of several codes called programming languages. Although students need to know how to program to benefit from computer technology, gaining such a skill gives them greater control of the medium and opens opportunities for later employment.

Teachers' Level of Computer Use

It should not be expected from every teacher to use the technology at the same level because of the differences in their enthusiasm, knowledge and competencies. Hardy (1998) describes five different types of teachers using technology at different levels. The first type, enthusiastic beginners, prefers very basic computer applications to support their direct instruction. The second type, supported integrators, employs computers for the following purposes: enabling students to create their own products and helping them demonstrate their skills and ideas during the class. Supported integrators use varieties of computer programs and allow students explore those programs by themselves. High school naturals are concentrating on quantitative and analytic functions of computers and they mostly use computers' programming function. Unsupported achievers employ computers for remediation and they do not make much use of sophisticated applications. Finally, struggling aspires make very limited use of computers for their direct instruction.

Moersch (1995) describes seven levels of computer uses in the classroom. At the first level use teachers do not use any electronic technology. The technology they use is text -based, such as chalkboard and overhead projector. In the second level, teachers do not use computers directly in the classroom. Students use computers outside of class to perform some tasks, such as writing papers with word processors and creating data sheets with spreadsheet software. In this case, there is very little relevance to the teachers' instructional activities. The third level application is using computers as a supplementary tool. Tutorial, game or simulation programs are used to extent class activities or provide enrichment. In the infusion level, which is the fourth level, varieties of software programs are used, such as databases, graphing packages and multimedia applications in classroom. However, those applications are isolated from instructional events. For example, communication tools are used among people to only share data rather than actual teaching and learning. The forth level of use are more teaching and learning oriented. Computers are used for presenting information in a meaningful way to students so that students are put in a real-like environment for authentic learning. At the expansion stage, technology goes beyond classroom. Students use computers outside of class to perform lesson-related tasks. The final stage is refinement. In this stage, the problems are authentic. The computer is the major medium to search and process data for the problems and to bring the authentic solutions.

Planning the Integration

The use of computers in classroom should be carefully planned for successful implementations (Grangennet et al., 1997). The literature describes several systematic and non-systematic instructional planning models for teachers to create technology-integrated lessons.

Guide (1989) indicates that in a technology planning process teachers should first identify the content of a lesson, goals and objectives of the lesson, and learning activities with computers. Once those are identified, the lesson should be planned at four levels: Introduction, information presentation, guided practice and closure. In the introduction, students should be motivated through discussing the topic and relevant experiences, and posing attention-getting questions. During the introduction, the computer can be employed to present graphical data to initiate the discussion, record the points and interesting views elicited during the discussion. Also, computer printouts can be provided with students to make them ready for the following activities. In the information presentation, students are confronted the knowledge, skills and competencies to be learned. Usually, computers are used to present those skills to students directly or help students manipulate the new information. For instance, students may use a tutorial software program because these programs explain information to be learned step-by-step. Guided practice is structured to provide independent practice to reinforce students' newly learned skills and knowledge. For example, drill and practice software can be used after learners understand how to solve certain mathematical problems. In closure, teachers should summarize the lesson and mention how students may use their new skills to solve real life problems. Presentation or simulation software would be appropriate for this stage.

Another framework for technology integration is NTeQ (integrating technology for inquiry) that provides a guideline to create a computer-integrated educational environment through solving meaningful problems. According to NTeQ framework, to plan a lesson, the following steps should be taken: specifying objectives, matching the objectives to computer functions, specifying a problem, planning the data manipulation, planning the presenting of results, planning student activities and planning evaluation. At the first phase, specifying objectives, teachers are supposed to cover all the skills students need to gain during the lesson or unit. Then, teachers evaluate each objective and match them with one or more functions of specific software programs. The functions are the tasks that software can do, such as calculation, drawing, matching and searching. After that, teachers create realistic problems. The problems are necessary because they will create an environment where students will generate critical thinking skills and gain necessary knowledge to reach the objectives. Also, teachers should consider how students would collect data related to the problems. They may identify a potential use of computers in data collection. Planning the data manipulation is related to how students will use the computers or what functions of computers they will employ to solve the problems. After students solve the problems with computers teachers should determine in what format students would present the results. Different presentation formats may help students see the results from different critical perspectives that would help make appropriate conclusion. The next step is planning student activities. Teachers should figure out what kind of activities would be better for students to solve the problems. The activities can either involve computer use or other classical applications, such as discussion and lecturing. The final stage is evaluation. Teachers should consider wide varieties of evaluation techniques, such as paper-and-pencil tests, a rubric and journal (Lowther & Morrison, 1998)

Sia (1992) says that, "when a teacher utilizes software to enhance instruction in a specific subject, he/she is putting software infusion into practice." The purpose of the software infusion is to achieve predetermined lesson objectives by incorporating appropriate computer programs. The followings should be considered in software infusion. Curriculum and software objectives should be aligned. Computer programs should be used wherever they may make contribution to the purpose of a lesson. Teachers should not intend to teach a whole lesson by a single software program. Rather, they should consider using wide range of software applications with their unique contributions to curriculum during a lesson. Teachers should not see technology integration very complicated and narrow their view about the utilization of the computer. For instance, besides using chalkboard, they may use a word-processing program to help students learn complex writing skills.

New technologies that can be used for educational purposes may require new planning and integration strategies. Internet is diffusing into education very quickly. Several internet-based lesson templates have been created for effective teaching. The WebQuest is a web-supported lesson template composed of five sections: Introduction, task, resources, evaluation and conclusion. The purpose of introduction is to orient learners about what they will learn and gain their attention. The task section describes what student will be doing during the lesson. The resources have a list of pre-selected web pages that have resources to help learners accomplish the task. However, when needed, students may use resources other than the provided web pages, such as books, tapes and face-to-face interaction. In the evaluation section, the teacher explains students how they will be evaluated on the task they have to accomplish. The final section, conclusion, summarizes the experience and generalizes what was learned.

Technology, Teacher and Classroom

Technology has changed the teachers' traditional role and expectations in the classroom. Hardley and Sheingold (1993) indicate that with technology, classrooms have been changed from a teacher-centered educational environment to a student-centered environment. Teachers see themselves as learning facilitators or tutor providing students with help when they encounter problems in the learning process rather than as an expert who performs direct teaching. Students work more actively on their own within small groups in a collaborative way (Schofield, 1995).

Berg et al. (1999) observed that exemplary computer-using teachers employ technology in their classrooms in a manner that are overwhelmingly constructivist. On the other hand, students use technology as a tool to explore new information and create new products. Because student groups work independently in classroom teachers generate more time to deal with students' individual problems and provide more learning materials for them so that they may be able to learn and think more. Moersch (1995) states that "As teachers advance from one step to another step [improves their technology use step-by-step] instructional focus shifts from being teacher centered to learner centered. The computer technology is employed as a tool that supports and extends students' understanding of pertinent concepts, processes and themes involved when using databases, telecommunication, multimedia, spreadsheets and graphing applications. Traditional verbal activities are gradually replaced by authentic hands-on inquiry related to a problem, issue or theme."

Student Attitude and Anxiety towards Computers

There are two important issues that may affect the success of technology infusion in classroom: students' attitude toward and anxiety about computers. Computer attitude can be defined as an evaluative disposition towards computers. On the other hand, computer anxiety is a fear or aversive behavior that occurs when students use computers. Computer attitude and anxiety are among the major factors relating to students' success in learning (Lui & Johnson, 1998). Moreover, anxiety affects "the ability of individuals to use computers" (Anderson et al.,1984) and cause physical symptoms and discomfort (Ayersman, 1996). Due to their importance, the constructs of computer attitude and anxiety occupy a significant place in the literature (Lui & Johnson, 1998).

Two factors are considered important in computer attitude and anxiety: gender and experience. Investigating the relationship between gender and computer attitude, research studies revealed inconsistent results. Nelson and Cooper (1997) indicate that there is no significant attitudinal difference between boys and girls towards computers. However, girls use computer less than boys do and see themselves less skillful. Male students show better attitude toward computers than female students do. When programming is concerned there is a marked attitudinal difference toward computers between boys and girls in the favor of boys. Sacks et al. (1994) indicated that differences in findings may be due to instability in girls' attitude about computer across time. Also, another important finding is that boys provide unstable attribution to their failure but girls provide unstable attribution to their success.

Also, studies investigating the relationship between gender and anxiety revealed inconsistent results. McInernet et al. (1994) indicates that in using computer equipment and dealing with computer instructions males are less anxious then females and boys are more relaxed than. Chuna's et al. (1999) extended study revealed that female undergraduates are more anxious than male university undergraduates when they use the computer. In the contrary, the study by Anderson et al (1984) do not support the previous findings, which is that women in general exhibit higher levels of computer anxiety than man. Maurer (1994) took a different approach to the gender issue. Regardless of the gender, he described students with different identity as feminine, masculine, androgynous and undifferentiated. The results showed that feminine identity students had more computer anxiety than did masculine identity students regardless of gender.

Positive relationship has been found between computer experience and attitude- the more computer experience students have the higher attitude they show toward the computer (Levine & Donita, 1998). It was also found that computer experience might diminish the attitudinal difference between males and females. After having had the experience, female students exhibit better attitude toward computers. However, Maurer (1994) advocates that there is a controversy in the literature about experience. Not always experience brings high attitude. He says that computer attitude is related to the types of computer experiences or computer education students have .On the other hand, Ayersman (1996) indicates that any positive computer experience may reduce the computer anxiety, including workshops, classes, hands-on experiences and training. Even having experience with a privately owned computer at home improves students' attitude.

In addition to experience and gender, other variables are affective on computer attitude and anxiety. In science and math related areas, students experience attitude and anxiety-related problems (Sacks et al., 1994). Teacher attitude also affects student attitude in the classroom. (Dupagne & Krendl, 1992). If students are in a self-directed learning environment which is free of evaluation and assessment they have better attitude and show less anxiety toward computer than the otherwise (McInernet, 1994). Finally, access to computer determines students' attitude toward computers (Lui & Johnson, 1998). "Studies have showed that females are less likely to use computers if they have to compete for use time" (Sacks et al., 1994).

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Technology Explosion and Its Impact on Education

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Abstract

We are in the computer age and the federal and local governments have invested significant amount of money to purchase computers for schools. The average computer to student ratio has significantly increased. In the meantime, educational technologists have started questioning the effectiveness of computers in teaching and learning. The purpose of this paper is to investigate advantages and disadvantages of using technology in education and to identify the environmental (extrinsic) and personal (intrinsic) factors that cause schoolteachers and university professors unwillingness and lack of enthusiasm to implement technology in the classroom.

Introduction

Technology has a long history in education. Even though it has been accepted that the first educational technology endeavors started at the end of the 1800s with the school museums, the technology widely started being used after film, radio and television entered in the vision around the 1920s. Public schools modified their programs to some extent, such as rearranging class schedules, to infuse those technological innovations into the school system (Cuban, 1985). However, schools came across several problems including cost of films, insufficient hardware, awkward scheduling of broadcasts and inadequate teacher training. Moreover, the technological innovations at that time did not bring a new educational perspective. For instance, TVs were used as an accessory and substituted by teachers' lectures rather than as an essential instructional tool. Eventually, they disappear from schools very rapidly.

Now we are in the computer age and the federal and local governments have invested significant amount of money to purchase computers for schools. The average computer student ratio significantly increased. In the meantime, educational technologists have started questioning the effectiveness of computers in teaching and learning. The effectiveness of computers is still an issue and a consensus has not been provided among the researchers. However, the computers, as opposed to the other technologies such as TV and radio, have significantly impacted education from several perspectives. It has changed the teachers' role, the school curriculum and the educational research perspective.

The current studies illustrate that the teachers who are successfully employing the computers change their classical roles in the classroom, which are organizing, presenting and evaluating information. They prefer to become a mentor directing and motivating students to create questions, explore and manipulate information, and create solutions for the questions by themselves. They use more student-centered teaching approach and promote self-directed learning. Aligned with this approach, the curriculum has been modified to accommodate more problem-solving activities (Diem, 1996).

The potentials of computers have shifted researchers' attention to cognitive psychology (Shrock, 1995). Psychologists' traditional approach to education, which is measuring changes in students' behavior following educational stimuli, is joined with a concern about the process of cognition. They started considering human learning as the product of a cognitive process working based on cognitive rules and strategies rather than solely stimulus-reinforcement contingency. According to cognitive principles, education is control of cognitive processes in the learner. Learning is more and more being understood as recognition of learner knowledge structures by mapping teacher or expert subject matter knowledge onto the learner's knowledge structure (Popkewitz & Shutkin, 1995).

Advantages of Using Technology

Technology has produced several positive outcomes in education; enhancement of motivation, attitude and enjoyment, new peer interaction patterns and learning performance (Schofield, 1995). The idea that computer use often enhances students' motivation and attitude has been experimented frequently in the recent years. It is supported by many studies that computers are able to enhance student motivation about, interest in and attention to classroom activities.

In a study consisting of 30 fifth grade students in an inner city school, the effect of computer in mathematics, language-arts and social studies were measured. The results showed that the students had more positive attitudes towards the educational experience and their attitudes improved during the course of the study in the area of confidence (Kitabchi, 1987). Based on a meta analysis of 199 papers of which 32 were conducted in elementary schools, 43 in high schools, 101 in universities and 24 in adult education centers, it was founded that students liked the classes more and developed more positive attitudes toward computers when they received computer help (Kulik et al, 1987).

Having high attitude, students have more enjoyment, work harder and show more involvement in classroom while working on computers. Why are students motivated and enthusiastic with computers? The literature brings some explanations for this question. The first is that students respond well to computers because they are relatively new in their school experience. The second is that students seem they like working on computers because computers introduce variety into the school routine. Another approach is that knowing how to use a computer would be useful to students in the later life (Schofield, 1995).

Educators have been concerned with interactions among students in a computer-supported instructional environment. Many think that students are isolated from the classroom's social environment when using computers. Yet, studies showed that when students deal with computer related tasks interaction among students increases. As a matter of fact the interaction becomes a learning management tool and students' experiences in-group work may have a direct effect on learning and achievement (Webb, 1989)

Peer interaction has been affected by several factors such as student characteristics, the structure of tasks, and the reward structure (Webb, 1989). Besides those factors, locations of computers, the ratio of students to computers and how teachers chose to handle the educational environment when there are more students than computers determine the pattern of interaction among students. Teachers may control collaboration among students through software. One of the purposes of the education is to teach students necessary skills to prepare them for the job market. Even though there are some objections numerous researchers indicate that the computer is a good means towards that purpose. Many studies proved that students better learn in a computer-supported environment than traditional classroom environment.

Kulik (1994) conducted a meta analysis on more than 500 individual research studies of computer-based instruction. He found that on average, students who used computer based instruction scored at the 64th percentile on the tests of achievement compared to students in the control conditions without computers who scored at the 50th percentile. Also students learned more in less time when they received computer-based instruction. In a similar investigation, 219 research studies on the effect of technologies on learning and achievement across from 1990 to 1997 revealed that students in technology rich environments experienced positive effects on achievement in all major subject areas and showed increased achievement in preschools through higher education for both regular and special needs children (Sivin-Kachala, 1998).

Disadvantages of Using Technology

The technology implementations are not free of risk. Once the technology starts diffusing into schools it comes with unique problems. Some of the important problems are equity and access, time to plan and implement the technology and teachers' resistance to change.

In the technology-based educational change, which could be school-wide, district-wide and statewide, equity and access refers to whether each individual student utilizes computers or the technology at the same level and under the same conditions (Knupfer, 1995). The following variables would explain the obstacles that may cause inequity in the computer access: Geographic region, socioeconomic status, gender, race, various kinds of handicaps, and special learner groups within school. The research indicates that minorities, women, the handicapped and the poor have less access to computers (Anderson, Welch, & Harris, 1984).

Some other factors also may determine the equal access, such as familiarity with hardware and software, the classroom structure, time, students' skill levels and locations of computers. Becker (1985) found that above-average students dominantly use computers. Also, his study revealed that placement of computers within libraries promoted more equal usage of computers between above- and below-average students.

Successful technology adaptation requires a careful planning which demands plenty of time. However, teachers already undergo time shortage with their current tasks (Knupfer, 1995; Hardy, 1998). Time necessary for technology adaptation is not just limited to the planning. Teachers also have to commit some time to learn how to plan the technology integration into curriculum and develop appropriate materials. After all, they will need classroom time to implement the technology. In the current education system, besides other necessary classroom events not enough time is left to carry out instructionally sound and proper computer activities (Dupagne & Krendl, 1992). The literature confirms that teachers who are motivated to use the computer technology in their teaching are more likely to do so if time is provided to develop materials (Hardy, 1998).

Teachers show resistance to educational change in which they should use educational computing. Among several others, two concerns are critical for teachers exhibiting the resistance: Concerns about their machine skills and concerns about taking a risk (Andris, 1996). Teachers are supposed to be competent about computer machine-related skills for classroom and lab activities at least at the elementary level. Though, usually teachers learn those skills through, if possible, school or district supported training and peer tutoring after for a while they do not value their computer machine skills. Although these teachers agree that their machine skills improve over time as they operate computers, they distinguish those skills fromother teaching skills and do not recognize them as relevant to their teaching and they do not think, "operating computers make them a better teacher".

It takes time for teachers to become familiar with computer hardware and software. Because technology vendors continuously upgrade their products and schools always acquire new equipment and computer programs, this is a recurrent problem in schools. Teachers indicate that until becoming accustomed to computers and programs their schools have teaching with them becomes less efficient and less productive than teaching with classical methods. They think using unfamiliar computer materials and methods may risk their consistent level of classroom performance as well as effectiveness of their lessons.

The Effective Integration of Technology

The technology integration in classroom is perceived a complex and challenging procedure by new adaptors. Yet, later, getting more expert on educational technology competencies they see the integration easy and useful (Scrogan, 1989). Computers are promising educational tools facilitating teachers' tasks and improving students' performance. In addition to those, technology plays a central role in educational change (Sudzina, 1993). However, still educators exhibit reluctance to integrate computers into classroom (Dunn & Ridgway, 1991).

Researchers have been investigating the reasons why educators at all levels, schoolteachers and university professors; show unwillingness and lack of enthusiasm about the technology. Several causes have been discussed. However, it is very hard to put those reasons into an accurate categorization because they are not clearly separated from each other. Besides their effects on inadequate computer integration, they interact with each other, as well. However a categorization of the factors would be as follow: Environmental (extrinsic) factors and personal (intrinsic) factors (Dusic, 1998; Ertment, 1999). Intrinsic factors are the ones caused by the setting or situation in which the technology is implemented. Extrinsic factors are coming from teachers' personalities and understanding of technology integration.

Environmental factors

Providing adequate hardware and software is an important factor in promoting technology integration (Zammit, 1992). If computers are not available during convenient times and/or software is unavailable in sufficient quantities or at an adequate level of quality one should not expect high levels of usage regardless of the level of interest (Stieglitz & Costa, 1988). Schoolteachers and university professors indicate that the quality and quantity of hardware and software is insufficient (Hoffman, 1998). Schools and departments need more computers and computer peripherals, such as scanners and data projectors. The ones having computers and peripherals should continuously upgrade them due to the rapid change in technology. Software is not satisfying the educators' need. Teachers generally evaluate software as being pedagogically weak or inappropriate and think it is not worth the effort to use it (Zammit, 1992). What is generally needed is well designed, adaptable, user-friendly and uncomplicated computer programs. (Hardy, 1998; Downes, 1993; Ritchie, 1996; Cafolla & Knee, 1995; Sheingold & Hadley, 1990; Dunn & Ridgway, 1991)

Support also plays an important role in technology diffusion in education. The support may be in three different forms: Technical support, pedagogical support and management support. Technical support is important because teachers and faculties always need help with the equipment in classrooms. Most of the time, they are not able to overcome technical problems occurring during instructions and need to call a support person (Dusic, 1998; Hardy, 1998).

Pedagogical support is related to technology planning, development, implementation and teacher consulting. Pedagogical support should be provided by technology coordinators (Zammit, 1992). Technology coordinators are supposed to inform teachers of how to use certain equipment. Equipment use is not necessarily only limited to physical use but related to how that piece of technology is integrated into instruction, how to plan for its use, and how to improve students learning performance and motivation. Also, technology coordinators should enlighten teachers with concurrent educational technology innovations and learning theories/models (Ritchie, 1996). Hoffman (1998) claims that the pedagogical support provided by the coordinators leads to greater use of software

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that promotes higher order thinking skills, and greater use of computers as tools in academic activities rather than as mere drill-and-practice.

School boards, districts and school management are not providing adequate administrative support for technology infusion (Cafolla & Knee, 1995). Administrators from different management levels are key people making strategic and executive decisions within schools or school systems and universities. With those decisions, administrators may provide teachers with directions about educational technology use, involve teachers in the technology adaptation process, provide necessary hardware and software, provide incentives that can encourage and motivate teachers to start and continue integrating technology into their lessons (Hoffman, 1998; Knupper, 1989; Dupagne & Krendl, 1992). One solution to overcome this problem and widespread the technology in schools is to train administrators on educational technology and make them comfortable computer users so that their attitude towards technology is improved and they provide more help teachers to integrate technology in their lessons (Ritchie, 1996). The following factors are also considered related to teachers' educational computer use: Risk of using technology, sharing of technology resources between teachers (Dusic, 1998), discouraging climate to use computer within schools, lack of use of computers for personal purposes and not having a computer at home (Downes,1993).

Teacher training

To this point, several environmental factors, such as lack of hardware and software, pedagogical and technical support, management support and so forth, have been discussed. Teacher training also occupies an important place as an environmental obstacle (Hardy, 1998; Dusic, 1998). Significant number of teachers had very little in-service training about educational technology (Zummit, 1992). This might be the reason that one of the major concerns teachers and faculties carry is "hows" of using technology in the classroom (Dupagne & Krendl, 1992). Instructional computer applications require new competencies and knowledge. Not having those competencies and knowledge, teachers should not be expected to adopt technology in the classroom (Marcinkiewicz, 1995). Successfully technology-using teachers indicate that they learned their technology skills thorough formal and non-formal training; such as workshops, courses at local colleges, in-service training offered by their districts, in-service training at their school site and non-in-service courses offered by districts (Hoffman, 1998).

Even though teachers have positive attitudes towards technology and want to improve their teaching performance through technology implementations they are not able to accomplish it. They are not having knowledge to use the machine, and not having any kind of familiarity or expertise with computer based or computer managed instruction (Onika, 1992). The reason is that experienced teachers have not had appropriate training on how to effectively use the computer in the classroom and on technology, skills, ideas and ways to integrate instructional technology into the curriculum (Dunn & Ridgway, 1991). In addition to this, new teachers have very limited knowledge about educational computer use. Teacher students do not have adequate exposure to instructional technology because many educational institutions and faculties within those institutions have not adopted technology. Whereas, the more teachers have exposure to and experience with computers the better they integrate computers into their teaching. (Hardy, 1998)

Comprehensive staff technology teacher development models and programs are needed. Those programs should provide clear directions for teachers on integrating technology in classroom and help them construct the purpose and meaning of educational technology (Hardy, 1998). The training should be designed in a way so that it contributes to teachers' continuous development. Therefore, new adopters or new teachers should be encouraged to try out their developing IT skills early in their carriers, and not wait until their theoretical knowledge is highly developed (Dunn & Ridgway, 1991).

Personal Factors

Besides environmental factors as explained above, some psychological factors or variables, such as confidence, fear, will and motivation, may determine teachers' use of technology in classroom. Hardy (1998) indicates that around 40-50 percent of teachers avoid using computers because they lacked confidence, felt uncomfortable, and were frightened, threatened and intimidated by computers. Sometimes teachers' or faculties' belief about technology and education may determine their behavior towards technology use. They think computers are complicated machines to use and master. Also, some think it is a temporary movement within current schooling system rather than a useful trend. Teachers' traditional belief and experience with schooling inhibits them from taking instructional risks and implementing technological innovations in the classroom (Sudzina, 1993).

The literature concentrates on three major personal variables or factors: Anxiety about technology, teachers' or faculties' personalities and attitudes towards the technology integration. The major indicator of computer anxiety is avoiding from or interacting with computers (Dusic, 1998). Hardy (1998) indicates in a study investigating computer aversion it was found that teachers are very hesitant about computer related tasks, which includes using computer machine and related peripherals in teaching, helping fellow teachers when they have trouble with computers and applying to a job requiring an initial computer training. Some reasons are brought for computer anxiety, such as inadequate planning and applications of technology-based educational change and ineffective communication between instructors and administrators (George, 1996). Jordan (1993) adds the following three reasons: "Teachers, trained to master the traditional tools and materials of their profession, fear their lack of expertise with computers will be embarrassing and undermine their classroom authority, some teachers may be uncomfortable with the ways that classroom roles and relationships between teacher and student change when computers are introduced into the classroom, teacher productivity and student success can be monitored with computers easily, but many teachers worry about accountability since the problem solving skills they try to teach may not be measurable through assessment instruments they have been using". Improving self-efficacy would be a useful method to decrease teachers' anxiety. Self-efficacy is achieved through helping teachers use computers effectively, having them observe other successful users, mentoring teachers on the educational technology and creating anxiety-free environments or situations (Dusic, 1998).

Psychologists classify people according to their personalities. Some empirical research data shows that there are connections between educators' types of personalities and use of educational technology. Smith et al. (1995) attributes the features of being creative, analytical, logical and imaginative to institutive/thinking types of educators and says they are more open to educational technology than sensory types of people who are practical, realistic and sociable. On the other hand, comparing the other personality traits, sensory/feeling types of people show very reluctant behavior towards adapting technology in the classroom. In a similar study, the personality types were classified as follow: extraversion/introversion, sensing/intuition, thinking/feeling, judging/perceptive and it was found that those personality variables may determine the amount of technology training taken, perceived adequacy of the training, perceived support from management and perceived factors or barriers to adapt computers in curriculum (Knupper, 1989).

Teacher attitude

Teacher attitude is the most commonly used term in the literature to describe practitioners' appealing to educational computing. For instance some teachers perceived that computers did not provide a distinct advantages over traditional methods of teaching (McCormak, 1995) some others value them as a useful tool to support meaningful learning. Attitude is defined as evaluative disposition based on cognition, effective reactions and behavior intentions and determines future behavior as using the computer as a professional tool and integrating technology in the classroom (Dusic, 1998). As can be seen from the definition it covers a very broad meaning. Due to that it is used interchangeably with motivation and anxiety. As a matter of fact, attitude scales are created based on other psychological states. For instance, Loyd (1985) created a computer attitude scales derived from computer anxiety, computer confidence, computer liking and computer usefulness. Computer anxiety is related to fear of computer, computer confidence is about self-reliance to learn and use computers, computer liking is enjoyment from working with computers and computer usefulness is related to perceived effectiveness of computer.

Significant attitudinal difference towards educational computing is found between teachers who are technology users and those who are non-users (Galowich, 1999). The more teachers are willing to use computers in the classroom, the more their attitudes are favorable toward computers (Dupagne & Krendl, 1992). In addition to that, the teacher attitude is significantly related to computer literacy knowledge. Also, it is expected that there is a connection between using computer outside of work and the attitude (Galowich, 1999). Attitude is not a clear-cut measure to indicate teachers' disposition towards technology, such as high/good attitude and low/bad attitude. Teachers having different experiences, varieties of supports and different incentives and barriers may exhibit different attitudes.

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The Effects Of Computer Training On Turkish Teachers' Attitudes Toward Computers And The Effects Of Computer-Supported Lessons On Turkish Students' Reported Motivation To Lessons

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Abstract

Within the last 20 years, the quantity of computers in American schools has significantly increased. However, teachers have not been adequately using computers in the classroom. With a similar trend, the Turkish Ministry of Education has invested significant amount of money to purchase computers for public schools in Turkey. In this study, the effect of an educational computing training program on Turkish teachers' attitudes toward computers and the effect of computer-integrated classes on Turkish students' motivation will be investigated.

The subjects of this study are 21 middle school teachers and their school students in Turkey. There are two independent variables. The first independent variable is teacher training. The second one is computer-supported instruction implemented by the trained teachers.

Introduction

This study will investigate the use of computers in Turkish schools through teachers' attitudes toward computers and students' motivation to utilize computer-integrated lessons. However, since empirical studies about computer usage in Turkish schools could not be located, some data for American schools will be presented first to indicate what might also be true for Turkish schools.

Within the last 20 years, the number of computers in American schools has significantly increased. While there were 46,000 school computers in 1980 (Adams, 1985), the Office of Technology and Assessment (1995) reported that this number had increased to 400,000 by the end of the 1980s. As of 1994, schools nationwide owned an estimated 5.5 million computers (Mehlinger, 1996). Even though the number of school computers increased sharply, the percentage of computer use by teachers for instructional has remained low. The Office of Technology Assessment (1995) reported that, "a substantial number of teachers indicated little or no use of computers for instruction." Based on a national survey, Becker (1991) reported that only 17% of secondary mathematics, science, and English teachers utilized computers in the classroom "throughout the year" or "intensively, but only for certain units."

Another issue in educational computing is that computers have not been employed in an appropriate manner in the classroom. There are large qualitative gaps among teachers in using computers for instruction. Sheingold and Hadley (1990) conducted a research study on who were exemplary computer using teachers and noted what made them the exemplary. It was found that exemplary teachers utilized the computer as a multipurpose tool. On average, 95% of the exemplary teachers used the computer as a word processing tool, 89% as an instructional tool, 87% as an analytic and information tool, 84% as a programming tool, and 81% as a game/simulation tool. On the other hand, a 1989 national survey on how computers are usually used in American schools revealed that only 1% of computer-using math teachers applied spreadsheets more than five times during a year, while just 11% of computer-using English teachers said they used spell checkers regularly (Becker, 1991, 1994). This was a sharp distinction when compared to 56% and 61%, respectively, between exemplary computer using teachers and typical computer using teachers (Sheingold and Hadley, 1990).

Possible reasons for these discrepancies may be that teachers do not have the knowledge and skills about how to adapt computers to the curriculum or they have not received adequate teacher training on educational computing. The American Association of Colleges for Teacher Education (1987) conducted a survey among new teachers. This survey revealed that only 20% of the teachers entering the profession perceived themselves as prepared to teach with computers. In another study, Wiley (1992) selected 231 teachers to survey who would participate in a technology staff development program. He found that though these teachers had positive attitudes toward computers, they had insufficient knowledge about computers and strategies to effectively integrate computers into the curriculum. Okinaka (1992) concluded that lack of knowledge or understanding on how computers can be effectively used in the classroom is the most significant factor slowing the computer adoption process by teachers.

The purpose of this study is to understand how Turkish teachers respond to an instructional computing training program design based on data from research conducted in the United States, and how Turkish students respond to computer integrated lessons created by trained teachers. More specifically, this study is to investigate whether computer trained Turkish teachers improve their attitudes toward utilizing computers in regular course instruction. In addition, this study will investigate whether Turkish students' motivation toward lessons, i.e. mathematics, science, and Turkish, could be improved through computer-integrated classes designed and implemented by trained teachers.

Literature Review

Kay (1993) constructed and applied a 7-point Likert-type computer attitude measure based on four constructs. These constructs were affective attitude, cognitive attitude, behavior, and perceived control over computers. She found that there were significant relationships between affective attitude toward computers and computer behaviors, as well as cognitive attitude toward computers and computer behaviors. In another study, Pencer et al. (1992) surveyed 230 psychology undergraduate students to predict computer-related behavior based on computer-related attitude. Regression analysis shown that 17 computer-related behaviors could be predicted from the subjects' underlying attitudes.

For validating a scale to assess changes in teachers' attitudes toward computers, Kluever et al. (1994) surveyed 265 teachers participating in a training program. Significant difference was found between the students' attitude toward computers pretest scores before the training and posttest scores after the training. Yildirim (2000) investigated "the changes in attitudes of pre-service and in-service teachers due to participation in an educational computing class and the factors that contributed to the teachers' use of computers." It was found that after the class teachers' computer anxiety was significantly decreased and their computer liking and computer confidence were significantly increased.

Investigating the relationship among computer achievement, attitude toward computers, and environmental variables - such as computer access, computer help, and computer requirements - Liu & Johnson (1998) conducted research involving 138 female and 70 male teacher education students enrolled in a required basic computer technology course. The regression analysis showed that there was a significant motivational impact on students' learning performance.

A study was conducted by Perez and White (1985) to "explore motivational and educational differences between microcomputer activities and classical classroom activities." In the study, it was concluded that "a computer learning environment introduces and increases usage of varied motivational and educational factors which have the potential to improve learning as well as academic interests" (p.42).

Seymour and Sullivan (1984) surveyed 139 fifth and sixth grade students in six classrooms to investigate the relationship among continuing motivation of instructional medium, task difficulty, and sex of subjects. The two media that were used as instructional interventions were computer and paper/pencil with two difficulty levels: hard and easy. Continuing motivation was defined as "students' choice of instructional medium for a second learning task after they had completed an initial task either on a microcomputer or paper/pencil form." Factorial ANOVA analysis detected that there was a significant motivational difference between the two groups in terms of preferring one of the two learning mediums for a possible second learning task.

Method

Participants

The participants of this study are middle school teachers and their students of a private school in Turkey that offers kindergarten through eighth grade. The number of middle school teachers participating in this study is 21 (ten females and eleven males). Their distribution according to the subjects they teach and gender is as follow: four mathematics (two females and two males), two science (two males), four Turkish (two females and two males), three social science (one female and two males), and eight English (five females and three males). Their teaching experience ranges from two to ten years with an average of 4.5 years.

Independent Variables

Since there are two interventions in this study, there are two independent variables. The first independent variable is teacher training. The second is computer-supported instruction implemented by the trained teachers in the actual classroom environment.

The first independent variable, teacher training, had two levels: (a) no teacher training and (b) teacher training. The training was designed to teach in-service Turkish teachers educational computing competencies rated as important or very important by their American counterparts. During the training, Turkish teachers were provided with exposure to, knowledge about, and experience with educational computing.

Initially, teacher computer competencies were identified. The first set of competencies was identified by Scheffler (1995), who found 127 teacher computer competencies through literature review and interview with computer representatives. Using the Delphi technique and survey method, Scheffler (1995) reduced 127 competencies to 67.

In another study used to discover teacher computer competencies, Berg et al. (1998) utilized two evaluation phases to identify exemplary technology uses by teachers and students in elementary classrooms in southwestern Ohio. 39 distinct exemplary classroom applications of computers were found, 11 of which were specifically for teachers.

The specific computer competencies taught in the training were derived from those two lists. From the first list, the items that were rated 4 or 5 (important and very important) and related directly to teaching and learning activities performed by classroom teachers were selected. The ones that were not directly related to computer skills teachers may require, not directly related to teaching and learning in the classroom, and the ones that were similar in nature were eliminated. Some eliminated competencies were "demonstrate to students and other classroom teachers the computer as a beneficial tool that increases efficiency and productivity," "demonstrate skills in using a computer keyboard," "demonstrate appropriate use of computer technology for basic skill instruction," "use modem for communication between computers," "define elements of a local educational agency technology plan," and "plan methods to integrate computer awareness and literacy into the existing curriculum." This elimination resulted in 26 usable competencies.

From the second list created by Berg et al. (1998), the competencies specific for teachers and rated 5 or 6 (moderately important and highly important) were selected. This selection resulted in 5 competencies. The total competencies grew to 31

The second independent variable, teachers' implementation of a computer-supported class in an actual classroom, environment, has two levels: (a) implementing a computer-supported class in the classroom and (b) implementing a non-computer-supported (classical) class in the classroom. After the training, teachers will be required to design and implement a sample course in an actual classroom setting using the skills, knowledge, and competencies acquired through the training. This second intervention will be used to measure to what extent teachers who had the educational computer training will increase their students' motivation towards lessons.

Dependent Measures

There will be two dependent measures:

1. Teachers' attitude towards computers as measured by the Computer Attitude Scale.
2. Students' motivation towards courses by the Course Interest Survey.

Attitude is defined as "an evaluative disposition based upon cognition, effective reactions, behavior intentions, and past behaviors which can influence future cognitions, effective responses, intentions, and behaviors" (Dusic, 1998). In this study, the Computer Attitude Scale (CAS) (Loyd & Loyd, 1985) will be employed to measure teachers' attitudinal change towards computers after the intervention.

The CAS has 40 Likert-type items presenting statements of attitudes towards computers and the use of computers. The items are divided into four categories each of which represents one subscale of the CAS: (a) anxiety or fear of computers that represents the Computer Anxiety (CA) subscale, (b) confidence in ability to use or learn about computers that represents the Computer Confidence (CC) subscale, (c) liking computers or enjoying working with computers which is the Computer Liking (CL) subscale, and (d) perceived usefulness of computers in present or future work representing the Computer Usefulness (CU) subscale. Each subscale has ten items and respondents rate items by indicating to what extent they agree or disagree with the expressions in each item (from strongly disagree to strongly agree with four choices)

The estimated total alpha reliability coefficient of the CAS is 0.95 with the following coefficients for the subscales: 0.90 for Computer Anxiety, 0.89 for Computer Confidence, 0.89 for Computer Liking, and 0.82 for Computer Usefulness. The CAS is a reliable and valid instrument to assess teacher attitudes toward computers (Loyd & Loyd, 1985).

Driscoll (1993) defined learning motivation for a student as "deciding to engage in a learning task and persisting in that task." In this study, Keller's (1995) Course Interest Survey (CIS) was used to measure students' motivation toward computer-supported and non-computer-supported lessons. The CIS measured students' motivation to learn in a particular course. It had 34 items divided into four categories: (A) attention, (R) relevance, (C) confidence, and (S) satisfaction. The items in the attention category measure whether the interest of learners was captured and their curiosity to learn stimulated by the lesson. The relevance items inquire as to whether the personal needs/goals of the learner were met to affect a positive attitude. Items related to confidence evaluate the perception of learners about whether they will be able to succeed and control their success. Finally, the satisfaction items measure whether students' accomplishments in the classroom were reinforced.

Cronbach's alpha coefficient for the total survey was found to be 0.95. The subscales' coefficient values were: 0.84 for attention, 0.84 for relevance, 0.81 for confidence, and 0.88 for satisfaction. Additionally, it was found that there were significant correlations between the CIS results and course grades (Keller, 1995). They show that CIS was a reliable and valid tool to measure students' motivation in a specific classroom situation.

Both instruments, the CAS and CIS, were originally written in English and the English versions were validated. Because the teachers' and students' native language in this study is Turkish, the researcher will translate the English versions of the surveys into Turkish. The translated surveys will be checked and corrected by two language experts. The language experts are studying Turkish linguistics and literature in the United States, and are fluent in both American English and Turkish. No data is available about the reliability of the Turkish versions of the surveys. They will be calculated after the surveys are administered.

Procedure

Using a stratified random sampling method, I assigned 21 middle school teachers to either a control group or an experimental group. First, all 21 teachers were stratified according to their subject matters: mathematics (four), science (two), social science (four), Turkish (three), and English (eight). Second, half of the teachers within each stratified group were randomly assigned to either a training group or a control group. However, some teachers who were randomly assigned to the training group indicated that they would not be available for the training. They were then replaced with teachers in the control group. This assignment resulted in 11 teachers in the training group and 10 teachers in the control group. All 21 teachers will complete the Teacher Consent Form and the CAS before training is administered.

The training will take place at the school site. It will be given by the researcher in Turkish and take approximately 30 hours. The training will be given in a classroom lecture format to provide teachers with verbal information on how computers can be integrated into curriculum. Besides the lectures, computer lab sessions will be arranged to provide teachers with hands-on computer skills and competencies. From the instructional flow diagram, it is predicted that the lab section will take approximately 15 hours and the class section 20 hours.

After completing the training, teachers will design a sample computer-supported class based on the knowledge and skills they gained through training and implement that sample class in an actual classroom setting. Before implementation, each teacher will have students complete the Student Consent Form and the CIS. After the implementation of the computer-integrated class, students will again complete the CIS. Meanwhile, when teachers in the control group teach the same topics in the same lessons, such as mathematics, science, and Turkish without computer support, they will have their students complete the Consent form as well as the CIS. Finally, all 21 teachers will fill out the CAS.

Because the same students and the same teachers will answer the pretest as well as the posttest, pretest sensitization is an issue. Pretest sensitization refers to "improved score on a posttest resulting from subjects having taken a pretest. In other words, taking a pretest may improve performance on a posttest, regardless of whether there is any treatment or instruction in between" (Gay, 1996). To avoid the pretest sensitization, the pretest will be administered at the beginning of the study. This will make approximately 50-day gap between pretest and posttest. This time gap may minimize the pretest sensitization (Gay, 1996).

Hypotheses

Derived from the four research questions in the Introduction section, two hypotheses are provided. Each hypothesis was based on the information in the literature review section.

Hypothesis 1: Effect on Teacher Attitude Towards Computers

That the trained teachers will change their attitude towards computers, which will be detected by the CAS employed after the training. More specifically, that the teachers who receive the educational computer training, which aims to teach the computer competencies rated as important or very important by American computer using teachers, will record higher scores on the attitude questionnaire than those teachers in the control group who receive no training.

Hypothesis 2: General Effect on Students' Motivation

Students who receive the computer-supported classes will exhibit higher motivation detectable by the CIS form. In addition, students who have computer-supported classes, designed and implemented by the teachers who received the educational computer training, will exhibit higher motivation towards the lessons than those students who receive the same versions of the classes with no computer support.

Research Design and Data Analysis

For each hypothesis, a different research design and data analysis technique will be employed to minimize the statistical errors.

Hypothesis 1: For the first hypothesis, the research design technique will be a pretest/posttest control group design. Because the study deals with differences in teachers' computer attitudinal scores, a control group will be used to better understand whether the motivational difference between the control and experimental groups is due to the treatment, and not due to other factors. In this type of design, there are two groups of subjects, both of which are given a pretest of the dependent variable. Then, one group receives treatment and the other group does not. Finally, both groups take the posttest. The effectiveness of the treatment is determined by comparing the posttest scores (Gay, 1996).

In this study, there are only 21 teacher subjects. This limited number of subjects may bring some questions about validity and reliability of research due to the violation of some assumptions in parametric tests. For the data analysis of the first design, the Wilcoxon-Mann-Whitney test will be employed to measure the significance of the training. The Wilcoxon-Mann-Whitney test is a powerful non-parametric test that is useful alternative to a t-test procedure when a researcher wants to avoid the negative effects of assumptions in parametric statistics, such as the normal distribution assumption and equal variance assumption (Siegel & Castellan, 1988).

Hypothesis 2: Similar to the previous method, the pretest/posttest control group experimental design procedure will be employed for the second hypothesis. Because analysis of pretest/posttest gained scores has several disadvantages, pretest differences can be better controlled by covariance (Gay, 1996). Thus, ANCOVA (analysis of covariance) will be employed for data analysis in this study, and pretest scores will be used as a covariate.

Because no study was found where the CAS and CIS were administered to the control group and the experimental group at the same time, no previous data is available about the mean scores and variances of both groups, and statistical power cannot be estimated without this information (Feldt, 1993). After collecting data and calculating descriptive statistical values, the statistical power will be calculated.

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Formation of Community in a Distance Education Program

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Abstract

One of the biggest challenges facing distance education programs is attrition. One potential way of reducing attrition is to foster a sense of community among students. Students who are emotionally and intellectually invested in each other and in their program are more likely to prosper in a multi-year distance program. This paper briefly explores those effect ascribed to community that are assumed to be crucial for distance education programs to succeed, and then focuses on a theoretical framework knows as the Psychological Sense of Community (PSOC). From this basis the communication between graduate students in a distanced education cohort is explored to see how well the PSOC can be applied to this environment.

Introduction

The advent of the World Wide Web has brought with it a massive proliferation of distance education options, many of them based around extensive online communication. Unlike the correspondence courses that preceded them, this new brand of distance education features opportunities for student-student and student-teacher interaction. Many are also built on a different economic model; a full degree program may take several years, requiring a long-term commitment between the student and the offering institution.

Modern pedagogical models encourage the use of group work, learning communities and cohorts to help prepare students for a work world in which teamwork plays an important role. Implemented as a distance education option, this model requires a robust technology infrastructure and intensive faculty involvement — requirements that have a significant economic impact. A program that experiences high attrition (for example, starts with 20 students and ends up with only 3 at the end of a 3-year degree progra m) will quickly become a monetary sinkhole as course design, development, and faculty interaction time is subsidized by fewer and fewer students.

With both pedagogy and attrition in mind, many scholars have begun to focus on creating community, particularly "learning communities." Unfortunately, the terms are often vaguely defined. How does one know to what degree community is present? What positive attributes can we ascribe to such a community if it does exist?

This paper briefly explores those effects ascribed to community believed to be crucial for distance education programs to succeed, and then focuses on a specific theoretical framework, the Psychological Sense of Community (PSOC), that seeks to define community. From this basis, the communication between graduate students in a distance education cohort is explored to see how well the PSOC can be applied to this environment.

Review of the Literature

Distance education and attrition

Among the challenges faced by those implementing a distance education program — poorly understood technology, high demands on faculty time, and growing competition — perhaps the most significant challenge comes in the form of attrition. Reports of attrition rates at the course level in distance education vary wildly from study to study but are generally higher than on-campus courses (Dille & Mezack, 1991; Kember, 1995).

Isolation, "the state where one's achieved level of social contact is lower than one's desired level of contact" (Altman, 1975), is one of the most prevalent reasons given for dropping out of distance education courses (Morgan & Tam, 1999). Cut off from in-class as well as serendipitous encounters with their classmates and instructors, students lose the sense that they belong to something (Morgan & Tam, 1999; Want & Grimes, 2000).

Attrition can potentially be addressed through the formation of a learning community, specifically by engendering in students feelings of belonging. Of course, feeling isolated is not the only factor influencing student drop-out (Brown, 1996; Nippert, 2000; Want & Grimes, 2000), but belonging to a community seems to serve both the student and the institution by reducing such feelings and hence attrition (Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000; McCarthy, Pretty, & Catano, 1990; Morgan & Tam, 1999; Palloff & Pratt, 1999). Encouraging a sense of community, then, offers us a way to address the issue of retention.

Community and attrition

Lack of community is linked with two student attributes associated with attrition: student burnout (McCarthy et al., 1990) and feelings of isolation (Haythornthwaite et al., 2000). McCarthy et al. (1990) note that undergraduates who experience a strong psychological sense of community in their living environment reported lower burnout on the Meier Burnout Assessment and the Maslach Burnout Inventory, compared to students who did not. They suggest that programs and interventions to prevent or decrease burnout should focus not simply on individual students (such as improving their coping skills), but the college community itself. Haythornthwaite et al. (2000) found that students who do not make connections with their classmates at a distance "report feeling more isolated and stressed than those who are more active; exchanges with other students become vital for validating their experiences and for overcoming isolation" (p. 1).

Learning communities and virtual communities

The notion of a community of learners has been gaining currency in various educational fields for a number of years. Similar in many respects to Lave and Wenger's (1991) community of practice, a community of learners, or learning community, can take a number of forms and can fulfill a variety of needs. This term has become a buzzword applied to almost any educational or workplace group, especially with respect to online or virtual communities. While there is a wide variety of research focusing on such learning communities, many (Baker & Moss, 1996; Bielaczyc & Collins, 1999; Boehmer & Waugh, 1997; Brower & Dettinger, 1998; Cross, 1998; Hill, 1985; Lawrence, 2000; Pike, 1997; Shapiro & Levine, 1999; Wilson & Ryder, 1996) seem to accept the term at face value without attempting to rigorously define the characteristics that differentiate a true learning community from any other class. Others describe characteristics of community, but do not offer a way to evaluate presence or level of community (Bauman, 1997; Bruckman, 1996; Cox, 1997; Donath, 1999; Everhart, 1999; Kim, 2000; Kollock & Smith, 1999; Preece, 2000; Schwier, 2001; Selznik, 1996; Wellman & Guila, 1999a) .

Linked to this question of how to evaluate the existence and effectiveness of community are the ways in which researchers view community. The preponderant method is to establish a list of characteristics indicating the presence of community. Using these characteristics as a lens, the researcher then looks for indicators of those characteristics in the available data, and determines whether (or to what extent) the group is a community (see, e.g., Kim, 2000; Schwier, 2001; Selznik, 1996; Wenger, 1998).

Another way to define community is through its structure. Social network theory uses relationships among people (as defined by "weak" and "strong" ties and relations) to determine a person's social network (Wellman, 1979, 1999; Wellman, Carrington, & Hall, 1988; Wellman & Guila, 1999a, 1999b). To define virtual community by interaction, a researcher determines what kinds of exchanges are occurring among classmates, how regular and frequent they are, what the tone and level of intimacy are, and what the potential topics are (e.g., "work-related" or "friendship"-based). These data are used to create maps of how the students interact, allowing the researchers to derive models of how information and other resources flow through the group.

The methods and models referenced above focus on determining whether or not a group of people exhibits externally defined indicators of community. Puddifoot (1996) calls into question such quantification: "It is not apparent whether community identity can be established in any empirically objective way, or indeed whether this should even be the goal" (Puddifoot, 1996, p. 328). There is a construct, well known in the community psychology literature, of "psychological sense of community" (PSOC) (Glynn, 1981; McMillan, 1976; McMillan & Chavis; 1986, McMillan, 1996). Simply put, this is the individual's perception of whether or not she belongs to a community, and it is this construct that forms the basis of our investigation.

McMillan & Chavis' Psychological sense of community

In their seminal 1986 article, McMillan and Chavis sought to describe a sense of community and offered four criteria necessary for any acceptable definition. Any definition, they said, must be explicit and clear. It must be concrete, with its parts identifiable. Finally, say McMillan and Chavis, it must represent the "warmth and intimacy implicit in the term;" (p. 9) and provide a dynamic description of the development and maintenance of the experience. Their model has formed the basis of much of the work done in the field of community psychology, but has not had a noticeable impact in the world of education.

The PSOC, as its name implies, is based in the idea that many of the benefits ascribed to community come from an internal sense of community, irrespective of any externally-observable characteristics about the group in question. While designed with place-based neighborhoods in mind, McMillan and Chavis assert that their definition of sense of community will apply equally to both place-based and non-place-based communities.

The model entails four elements (Membership, Influence, Needs, and Emotional Connection), each of which has a series of sub-characteristics. These elements, shortened to the acronym MINE throughout the rest of this paper, are described in detail below.

Membership

Membership deals not only with who is in or not in a community, but with the sense of safety that accompanies such delineation. The ability to identify another member of a community allows one to better determine how to spend resources and with whom to feel comfortable. Integral to the idea of membership is the concept of boundaries. It is perhaps just as important to know who is not in the community as it is to know who the members are.

Boundaries can be created and enforced in many ways, including a group's use of language, styles of dress, and rituals. Gang members, for example, are able to tell at a glance if they are facing a friend or foe by looking at the person's colors. In this case, even more than most, the creation and maintenance of boundaries, as demonstrated by dress or rites, is a protection against external threat. Similarly, a common symbol system aids in creating and maintaining group boundaries. These symbols combined create a social convention that again delineates the "us" versus "them." Symbols may operate at the group level (black leaders using Black Power and clenched fist), the neighborhood level (name, landmark, logo, architectural style), or national level (holidays, flag, language, currency).

Safety, especially emotional safety, is embodied in the idea of security in one's community. Established boundaries provide structure and security, protecting group intimacy. In many cases, such support is emotional in nature, but in the case of gangs or warring factions, the security is physical; for collectives and cooperatives, the security can be financial.

The expectation that one fits the group and is accepted by the group is a sense of belonging and identification. The member feels he has a place there, and is willing to make sacrifices for the group. The member identifies with the group, which is reflected in reciprocal statements such as "This is my group" or "I am part of this community."

Personal investment also contributes to an individual's feeling of group membership and feelings of belonging. McMillan (1976) asserted that working for membership will provide the feeling that one has earned a place in the group, and that consequently, this personal investment will make the membership more valuable.

Influence

Influence is the second overarching element of the psychological sense of community. Influence is bi-directional: in order to be attracted to the group, an individual must have the potential of influencing the group. The reverse case — the ability of the group to influence its members — is crucial to maintaining cohesiveness. These seemingly opposite forces do appear to work simultaneously, indeed, in concert. Note that influence often operates independently of positions of authority.

An important aspect of influence is the idea of consensual validation, which assumes that "people possess an inherent need to know that the things they see, feel, and understand are experienced in the same way by others" and people will go to great psychological and emotional lengths to reassure themselves that they are not crazy (McMillan & Chavis, 1986, p. 11). One cause, then, of group conformity, is the pressure on the individual to experience harmony with the group's world view. Again, this pressure can move from the individual into the group as well as being imposed by the group on the individual, so that the group is "operating to consensually validate its members as well as to create group norms" (McMillan & Chavis, 1986, p. 11).

Integration and fulfillment of needs

The third element of the psychological sense of community is the integration and fulfillment of needs, most commonly encompassed by issues of reinforcement. Obviously, the individual's association with the group must be rewarding for the members. In many cases, a reinforcing element is just the status of being a member of that group. The benefit of being a member of the "in crowd" is simply association with that group.

Communities are also strengthened by group accomplishments. Simply stated, successes associated with group activities bring members closer together. McMillan and Chavis assert that competence is personally attractive and that people will gravitate towards groups and other people that offer the most reward.

A third way in which need fulfillment is given direction is through the concept of shared values. People with shared values come together and find they have similar goals, priorities, and needs, and is more easily able to focus resources on issues that speak to those values . This encourages the belief that, as a group, they are better able to fulfill their needs in a continual, mutually-beneficial way. In this case, it is shared values that act as an "integrative force for cohesive communities" (p. 13). Note, however, that a group with a strong sense of community in which members do not necessarily have identical goals and priorities will still work together to fulfill all members' needs.

Shared emotional connection

The final component of the psychological sense of community is a shared emotional connection, which is based, in part, on a shared history. McMillan and Chavis point out that it is not necessary that all group members have participated in the history in order to share it, but they must identify with it.

To share a connection with others, of course, presupposes interaction with them. The "contact hypothesis" asserts that the more people interact, the more they are likely to become close. The quality of interaction is also important, in that positive experiences create greater bonds; as was noted earlier, group success creates cohesion.

Sharing emotional events is crucial in creating a sense of connection. The "shared valent event hypothesis" states that the more important the shared event is to the people involved, the greater the community cohesion. Groups who survive a crisis together feel an increased bond (e.g., war veterans). Closure to events is an important part of community unity; if the group's tasks are unresolved and interaction is ambiguous, the cohesion will suffer.

Investment in the community "determines the importance to the member of the community's history and current status" (McMillan & Chavis, 1986, p. 14). People who expend time and energy on projects will feel more emotionally involved in their outcome.

Finally, various types of intimacy affect the shared emotional connection. Intimacy is a type of investment: the emotional risk one takes with other members of the group can affect (and be affected by) one's sense of community.

Applying the PSOC framework

Working from this theoretical base, Chavis, Hogge, McMillan & Wandersman (1986) took these four major categories and used them to derive an instrument to measure PSOC in an individual, the Sense of Community Index (SCI).. The SCI, and hence the PSOC, have been used to describe both place-based (geographical, e.g. a neighborhood) and non-place-based (relational, e.g., an ethnic group) communities. McCarthy (1990) and Pretty (1990) validated the SCI for the undergraduate university community. Pretty has used the instrument in both the corporate world (1991) and with adolescents (1994).

In 1996, Sonn (1996) developed an "open response format interview schedule" to asses the four elements of the sense of community framework, then conducted semi-structured interviews (lasting 25-50 minutes) with 23 participants (p 420). He then used the elements of the psychological sense of community to frame themes emerging from the interview data, providing evidence that the PSOC model has construct validity in this environment.

Despite its preponderant use in the field of community psychology, only a single reference to this model in education was found: dissertation work by Chao (1999). In the next section, use of the theory underlying the PSOC to examine communications among members of an online distance education program is discussed.

Methods

Context

The research proposed focuses on a particular program, a master's degree in educational technology offered by a large, Midwestern university. The Education Technology Online Master's (ETOM) is a three-year, cohort-based program designed to give working professionals an opportunity to earn an M.S. in educational technology. The overriding concerns center on (a) the ability to maintain high standards of academic quality at a distance in a highly accessible format, and (b) economic feasibility and sustainability of the program.

The ETOM seeks to build on the success and structure of the on-campus master's progra m, while taking into account the needs of full-time employees. The coursework is essentially the same as that on campus; project-based with a great deal of group work, some individual development projects, a substantial amount of writing, and a mastery-based assessment process. These characteristics are considered essential by the faculty of the department, and frame the challenges of a distance program along both pedagogical and economic dimensions.

The ETOM is set up as a cohort; each group of students will travel through the three-year program together. While not all students will take all the same courses, the required courses will be taken with the same group of people in an effort to instill a sense of community and trust.

Participants

Participants for this study are distance students drawn from the online master's program previously described. Researchers received permission to view postings and chat transcripts from 15 of the 16 students in the cohort.

All participants hold full-time jobs, their positions split roughly equally among K–12, higher education, and the corporate world. Geographically, they are spread across three time zones. They range in age from 25 to 55. Nine of the seventeen are women. As individuals who chose to pursue an online degree in educational technology, these students all had above-average technical skills.

Data sources and collection

All data collected were the products of a one-semester online course offered during the Fall 2000 semester. Data were collected primarily from two sources. First is a series of online chats that took place throughout the semester, held most Wednesday nights at 8:00 and lasting between 1.5 and 2 hours. These weekly chats were the only scheduled "real-time" interaction the students had with the instructor, and were designed to give the students access to the professor to discuss issues surrounding the content, assignments, and due dates.

Attendance at the chats (after an initial time-zone mix-up) was excellent at the beginning of the semester and grew spottier as time went on. Roughly two-thirds of the way through the semester the instructor discontinued these whole-group chats because so few people were attending. They were reinstated at the request of a vocal minority, and attendance for the rest of the semester hovered around 7-8, or half the students. In total, there were 11 chat sessions comprising over 1000 separate entries.

The second source of data was asynchronous postings to the whole-group spaces of the course's web-based conferencing system. These were open throughout the semester, but the vast majority of the almost 200 postings in the conferences took place in two distinct threads dealing with end-of-project "lessons learned". All these data were collected from the electronic systems and reformatted for easier reading and for import into nVivo™.

Data analysis

Data analysis began with an examination of transcripts from both the asynchronous conference and the real-time chats. Each entry was examined (in context) for communication beyond simple task-oriented interaction; these were assigned a low-level code to denote the type of utterance.The unit of analysis, then, was not specifically limited to a whole phrase or even sentence; units ranged in size from a short phrase to several sentences.

Data were coded until the list of codes stabilized (at about 29 of these low-level categories). The entire data set was imported into nVivo™ and coded by the researchers; codes were often merged or added to the list as necessary. Finally, already-coded data were re-checked to make sure the definitions of codes hadn't drifted during this process.

Since the concern of this study is the students' sense of community, all comments made by the instructor were ignored (although responses directed at the instructor were, of course, included). Also ignored were those comments that involved purely giving and receiving course-related information (e.g., asking the instructor to define a term), answering a simple, information-oriented question (such as "What were we supposed to read this week?"), and in general, those questions and the resulting exchanges that were so task-oriented as to give no insight into the community feelings codified in the MINE framework. The researchers' interpretation of McMillan and Chavis led to the conclusion that such purely functional transactions are of little value when looking for evidence of PSOC.

In the end, the original 29 codes had been modified and reduced to a list of 22 different types of comments that seemed to relate, in some way, to issues represented in the sense of community model driving the analysis. Armed with this list of codes, the researchers returned once more to the PSOC theory. Guided by McMillan and Chavis (1986), and with ideas further refined from McMillan (1996) and Chao (1999), the data were categorized into the four major components of PSOC (membership, influence, fulfillment of needs, or shared emotional connection). The full results of this categorization can be seen in tables 1 through 4.

Findings and interpretation

Of the original 200 posts in the asynchronous conference and almost 1000 comments made in the chats (together equating to roughly 120 printed pages), 187 utterances were coded into at least one of the 22 relevant categories. These broke down into the four MINE categories as indicated in each of the following sections.

Membership

Themes Indicating Membership	Number
Indication this is a safe space	2
Offer of help /information without request	3
Shared symbol system	1
Basic verbal support	34
Humor of a personal nature	37
Reference by name	18
Member check	4
General question implying a request for support	2
TOTAL	**101**

Table 1: Themes indicating Membership

Membership subsumes ideas of boundaries, language, and other representations of a common symbol system, and a sense of belonging to the group and the emotional safety that comes from that group identification. These ideas manifested themselves in four broad categories.

In the case of this cohort, boundaries were artificially created and maintained by the enrollment structures. Only people enrolled in the program (and the professors and staff) had any contact with the group as a whole, so there was really no need to either delineate or enforce boundaries.

Working in an online format makes certain demands on students with respect to communication, but it also provides opportunities for the group to adopt certain shared symbols. The use of emoticons ("smilies," especially) was very common, and a few students had their own symbols that they attempted to share with the group (further discussed in the section on influence). With the exception of the construct "*see*" to indicate online presence ("I'll *see* you tomorrow"), non-standard symbols were not adopted by the entire group.

A few themes emerged that suggested that the students felt a certain degree of emotional and intellectual safety in the group. One student implied that she felt safe in the community and with respect to the instructor: "I can't believe I'm admitting this to the teacher, but I feel much better now that I've learned what I can ignore". One reason perhaps that people feel emotional safety in their group is that support is available. We infer that asking a question implying support: ("Is everyone surviving?") or giving basic verbal support ("I'll second that ;-)") demonstrates the feeling is that someone is available to provide the asked-for support. Thirty-four instances of basic verbal support were found. McMillan and Chavis claim that use of humor may also be an indication of emotional safety that shows the speaker is confident in her ability to connect with her peers on an emotional level. There were 37 uses of humor in the data set.

The feeling that one belongs and is accepted by the group can manifest itself in a few ways. Riger (1981) cites social bonding indicators that, for co-present communities, include the ability to identify neighbors and their children. In the studied environment this can be demonstrated by individuals' referring to each other by name ("Grace—I agree"). The use of names aids in feelings of belonging in that it creates intimacy. Students referred to each other by name 18 times.

Overall, more than 100 of the 187 coded utterances were related to the Membership dimension. This makes it by far the most often expressed aspect of community.

Influence

Themes Indicating Influence	Number
Voice minority opinion	9

Attempt to build/enforce symbol system	1
Ask for/give neutral/popular opinions	17
Ask for clarification	2
TOTAL	**29**

Table 2: Themes indicating Influence

As was mentioned previously, influence is bi-directional. Although individuals must have the potential to influence the group, the group's cohesiveness is contingent on its ability to influence members.

Although the role of an assigned instructor is different from that of an emergent an instructor can be considered an authority figure with whom structures (and hence influence over the class) can be negotiated. The bi-directionality of such influence was first illustrated at the face-to-face orientation. The instructor had mandated a Friday night due date for weekly assignments, but then noted that she wouldn't look at them until Monday. The students pointed out that most of the time they had free to work on the course was on the weekend, and so negotiated a Sunday night due date. This set the stage for later debates about due dates and assignments, immediately showing students that they had some power over the course and hence should be less hesitant to invest in the group.

While the existence and use of a shared symbol system is an indication of membership (via explicated boundaries), an attempt to create or enforce such a system is a matter of influence. Some students used acronyms and constructs common in online chat sessions, not all of which were taken up by the larger group. In one case, the student explicated her use of actions between asterisks to describe asides (e.g., *looks around for help*).This is way of expressing oneself that is standard and common in many chat rooms, but it was new to the students with more limited online communication experience and was never adopted by the rest of the group.

One of the most powerful indicators of influence is expressing a minority opinion. In this case, the speaker must take the risk of "going against the grain" and taking a stand opposite that of the group, or at least, the opinions expressed thus far. The level of risk perceived by the speaker is inherent in his preface to the divergent opinion: "If I could respectfully disagree and restate I believe them to be at least equal in a highly complex subject area." We found fewer than 10 examples of students expressing a minority opinion.

If expressing a minority or divergent opinion is a strong indicator of sense of community; a related indication of influence is trying to elicit or giving neutral or popular opinions: "Does everyone else agree with this view?"

A final indicator of influence that emerged from the data was when someone simply asked for clarification. This shows a willingness to be influenced by another individual: at the least, it indicates some level of investment in what the other person is expressing: "I'm intrigued by this question. Explain what you are thinking a little more."

Twenty-nine of the total utterances were related to influence. This represents roughly one-sixth of the total, and most of these were related to neutral or popular opinions.

Needs

Themes Indicating Integration and Fulfillment of Needs	Number
Ask for understanding or apologize	4
Request basic or immediate info	22
Exhibit experience/expertise	9
Express thanks	8
Be self-effacing/express doubts hoping for support	6
Express frustration	1
Request elaboration	1
TOTAL	**51**

Table 2: Themes indicating Integration and Fulfillment of Needs

According to McMillan and Chavis, an individual seeks out and maintains membership in a group because the group somehow fulfills his needs. Many of the utterances in this category are basically indicators of reinforcement and support, either expressing a need, or offering to fulfill another's need. For example, when someone asks for understanding or apologizes ("Sorry, I lost my connection") she is assuring the group of her continuing membership and indirectly requesting validation of the membership/relationship in spite of the error or violation.

On a more concrete level, some needs are not emotional in nature but are related to resources. As a member "in good standing" of a particular group, an individual has access to the expertise and intellectual resources of the group. It requires a certain level of emotional security within the group to ask for help ("I can't get the Participants list to show anyone"), or to show unfamiliarity and ask for information that appears to be common knowledge: "I hate to admit my ignorance, but what is IRC?".

The other side of the needs fulfillment coin is the offer of help, either solicited or unsolicited. Volunteering useful information to the group — especially in the absence of a request for such information — fulfills a number of roles, including exhibiting experience or expertise that other members will find attractive: "Karl and I were looking at AOL, and think it will speed things up a little." It's also an indication that the speaker feels it is worth her time and effort to help out another member of the group. This could be an indication that the speaker believes mutual success is linked to helping behaviors.

Finally, there is the need for external validation of suffering: the desire to complain to someone who will understand. This powerful attribute of community is used explicitly in support groups and similar counseling situations, but is no less important to a group that occasionally needs a safe space and sympathetic ears for venting: "We were dying in our group chat!"

Fifty-one of the total coded utterances were related to fulfillment of needs. However, almost half of these were simple requests for basic information.

Shared emotional connection

Themes Indicating Shared Emotional Event/Connection	Number
References to orientation	2
Ask about shared history	2
Express happiness being part of group	2
TOTAL	**6**

Table 4: Themes Indicating Shared Emotional Event/Connection

With respect to shared emotional connection, we found three distinct themes: asking about shared history, expressing happiness at being part of the group, and making references to the pre-program orientation, the cohort's first shared event, and their only face-to-face event to date: "I think that [orientation] was real important for retaining people, keeping people on the program, so that they felt some sort of commitment now to this group."

Bonds, as they relate to shared experiences, seem to correspond to the level of emotion involved rather than whether or not the experience was a negative one. Shared positive experiences can create strong bonds, but an increased bond is also reported by groups who survive a crisis. In this case, the students experienced a 4-day face-to-face orientation that was intentionally structured to have a high-intensity "boot camp" feel. Students immediately got down to work, worked, ate, and lodged together, and had four very full days of togetherness and things they had to accomplish. The orientation fits into the shared valent event hypothesis, which states that the more important the shared event is to the people involved, the greater the community cohesion. The final indicator of a shared emotional connection is a student expressing happiness at being part of the group; there were two utterances on this theme. As can be seen in table 4, only six of the original 187 utterances spoke to the shared emotional connection.

Discussion

As can be seen from the four tables, not only was there little evidence of PSOC in general (only 187 coded utterances in over 120 pages of text), but these did not represent all four areas of community well. The data show a paucity of evidence of a shared emotional connection (only six examples), and more than half of these coded passages spoke to issues of membership.

Perhaps more important, the majority of these utterances are in forms that could be easily construed as not indicating community so much as polite conversation. Roughly half of the coded data refers to three items: humor, giving basic verbal support, and simple questions asking for simple information. While these items certainly represent their respective characteristics of community, they seem to be in a form that could be incorporated into the pattern of conversation, mitigating their power as indicators. It is also the default for people who don't know each other well, who don't feel safe with each other, and who treat each other as strangers.

Given these findings—lack of coverage and the prevalence of coded items that may be primarily indicative of simple etiquette—we are hesitant to speak about any substantial sense of community in this group. The discussions studied had a task focus, lacking many of the social cues one would expect to see in a group with a high PSOC. Why was there so little evidence of community? While there are various limitations to the study (discussed below) that could account for the failure to find an existing community, the first and most obvious explanation is that substantial evidence of community simply isn't there to be found. Another issue may be the timeline — one semester. While some articles speak about developing community within the span of a single course (Eastmond, 1995; Hill & Raven, 2000) it simply may not be long enough using this type of analysis.

As indicated, there was also a noticeable focus purely on the tasks under discussion. This is partially an outcome of the communications available for analysis. Given a limited time in which students could discuss course assignments and feedback with the instructor, it is not surprising that little of it would be spent providing the social cues and debates that would indicate PSOC.

Limitations

This study uses "found data" — data collected after the course and analyzed long after its creation. While there are complete transcripts of the chat sessions and the contents of the asynchronous discussion, the data were analyzed without the insight into changing tensions and attitudes that analysis during the course itself may have provided. A future study will take place concurrently with the course itself, allowing for the exploration of issues as they arise.

This study also suffers from limited data access. While we had full access to the chats and asynchronous conferences, no interviews were completed and therefore it was not possible to follow up on interesting points. Data collected by colleagues speak to the importance of the orientation, which the current data set only begins to suggest.

Post-course communication with some students indicates the interactions that would have been found most interesting took place between individuals via personal email. Not only are researchers unlikely to be given access to personal email, but there is a strong sentiment that it is inappropriate to even ask for it. Students need at least one avenue of communication that they feel is secure.

Future work

Data analysis is hampered by the lack of a rubric for determining what makes a particular utterance a "strong" one. While the researchers don't rely heavily on counting utterances to gain insight into the class, we do feel we need a way to indicate that saying someone's name is not as powerful an expression of sense of community as expressing a minority opinion. The researchers hope to develop such a set of criteria and apply it to data from these same students in the upcoming semesters of their degree program.

Studying these new courses using data collection methods such as interviews and surveys will help to the researchers accomplish two goals. First, it may be possible to refine and validate the PSOC model for use in qualitative research of an online cohort, perhaps using the SCI itself to validate our analyses. Second, albeit may eventually be possible to correlate specific course structures and salient events to changes in the PSOC. This information can be used to inform the second round of design for the online program and, hopefully, have an impact on attrition and student satisfaction.

Conclusions

The psychological sense of community, as defined in McMillan and Chavis' (1986) model, appears to be a meaningful, well-established and powerful tool for the rigorous investigation of community. The model offers a lens through which to explore how a group of students perceives itself. Application of the sense of community to qualitative methods is in its infancy, but this model lends itself well to this type of investigation. Future work will help determine if the model is able to offer insight into real-world applications of course design and structures that may, in turn, affect attrition rates and student satisfaction.

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Information Literacy in Higher Education: Is There a Gap?

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Abstract

Before a student can become information literate, he or she must be taught information literacy skills. Higher education cannot produce information literate students if it does not first have information literate teachers. The purpose of this needs assessment was to investigate the current and optimal levels of information literacy among the faculty members at South Georgia College. A few key questions this assessment answers are: What is the current state of information literacy among SGC faculty? What is the optimal state of information literacy among SGC faculty? For those faculty members who are information literate, what technology are they using to demonstrate information literacy in their instruction? For those faculty members who do not use technology for gathering and presenting data in their course instruction, what are the reasons for why they do not? How can those who are not information literate be brought up to proficiency? How can those who are information literate help those who are not?

South Georgia College is a two-year public college under the University System of Georgia. Average student enrollment for SGC is between 1,200 - 1,250 students. There are 41 full-time faculty members who teach at the college. Only full-time, teaching faculty members from the major academic divisions on campus were considered as subjects for research. Each faculty member was asked to complete a closed-ended survey of ten questions to determine the overall information literacy of SGC's faculty based upon qualitative analysis. Then, six faculty members, two from each of the three major divisions on campus, were randomly selected and asked to participate in an in-depth interview to provide the qualitative analysis of the needs assessment.

The two instruments used to conduct the research were in-depth interviews and a closed-ended survey. The closed-ended survey asked objective, general questions concerning the perceived current and optimal levels of information literacy among SGC faculty, the needs of those who are information literate and the needs of those who are not, and the causes for why a gap exists between the current and optimal levels of information literacy among the faculty. The in-depth interviews were conducted after the surveys were tallied. The interviews focused on gathering subjective data from participants. The interview questions dealt mainly with measuring the gap between the current and optimal levels of information literacy among SGC faculty, identifying areas of concern for those faculty who are using technology as well as for those who are not, and soliciting support from those faculty members who are information literate to help bring those who are not up to task.

From the data collected, on average, the faculty at SGC were found to be performing at an acceptable level of information literacy. Both the survey and interview data supported this. However, several intriguing results surfaced, as did a few problems in the design of the instruments. The survey produced the finding that faculty members still prefer traditional printed resources for gathering information, probably because most still use lesson plans that were developed before electronic resources were popular or available. However, the first place faculty would look today for finding supplemental information is not traditional printed resources but electronic resources. The survey findings also revealed that the majority of participants do not know the laws and ethical standards associated with copyright on the Internet. Furthermore, most faculty members surveyed believed that even if specific technology were made available, a teacher would continue to rely on traditional means of information gathering. The greatest design flaw in the survey was that several participants could not speculate on general questions that asked them to rate the information literacy of all faculty. Academic Freedom is highly upheld in post secondary education; thus, participants did not want to guess at what their colleagues did in their classrooms because they truly do not know. The instrument designer did not consider this at the time the survey was created.

The most surprising issue revealed by the in-depth interviews was that most participants were able to distinguish between technology literacy and information literacy, even though the interviewer did not

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discuss technology literacy. A majority of the participants agreed that a teacher's use of technology in course instruction does not necessarily reflect his or her knowledge of information literacy. The in-depth interviews were not without flaw either. Only four of the Information Literacy Standards used to rate participants' responses were addressed in the interview questions. This was a huge oversight on behalf of the instrument designer.

In conclusion, several steps could be taken to help faculty members become even more information literate. One possible solution was addressed in the in-depth interview results. Several subjects said that on-campus conferences and workshops involving technology used to gather information would certainly help them. An inexpensive solution would be to hold periodical teaching circles in which a group of teachers from various disciplines convene once a month to discuss how they gather information and use it in their course instruction. This would be the most feasible solution to the problem. A third solution would be for the administration to promote the scholarship of teaching, which would include the exercise of information literacy skills. Through course instruction improvements, faculty members can begin to vie for specific grants and fellowships that reward those who excel in the scholarship of teaching.

Introduction

Several college faculty members have incorporated technology and various forms of up-dated information systems into their course instruction. However, for every faculty member who has up-dated his or her delivery methods, there is a faculty member who continues to utilize the methods associated with stale tradition. Interactive web pages, PowerPoint slides, and the Internet are specific technologies that faculty members are - or are not - using in lieu of textbooks, chalkboards, and printed materials to present new ideas on how to retrieve and deliver information to their students. The resulting gap is very clear, some faculty members are quite information literate in terms of electronic resources and some are not; nevertheless, all should be information literate to a certain extent.

Located in Douglas, Georgia, South Georgia College became part of the University System of Georgia in 1932. One of its primary missions is to promote the scholarship of teaching via the latest technology and instructional designs available. Within the past three years, two computer-based classrooms have been added to the campus to help promote teaching with the use of technology. Today, SGC has a total of three model classrooms used by a variety of faculty members to teach their subjects, such as psychology, history, and physics. Average student enrollment for is between 1,200 - 1,250 students. There are 41 full-time faculty members who teach at the college.

The Information Literacy Competency Standards for Higher Education, approved by the Association of College and Research Libraries in January 2000, provides a list of standards, performance indicators, and outcomes that define what the information literate student must be capable of achieving. The information literate student must be able to analyze what information is needed, as well as what information is and is not appropriate for the purpose involved. He or she then must know how to retrieve the information either individually or with a group for accomplishing a specific purpose (ACRL, 2000). However, before the student can become information literate, he or she must be taught information literacy skills. That is where the faculty member's information literacy comes into question. Higher education cannot produce information literate students if it does not first have information literate teachers (Roth, 1999).

Not only will this needs assessment be beneficial to the specific clients involved, it will also contribute to research within the scholarship of teaching. Similar two-year institutions can use this study as an example for conducting research at there own institutions. They can implement the recommendations from the results of this needs assessment at their institutions without having to conduct a formal needs assessment of their own. Finally, several new questions and needs emerged from the results of this research, such as the need for faculty members at South Georgia College to become better aware of the ethics and copyright laws associated with using materials from the Internet for instruction. The conductors of this needs assessment could certainly continue their research in more depth at South Georgia College; other assessors could continue this type of research at their schools as well.

A few key questions this assessment answers are: What are the standards that will determine who is information literate and who is not? What is the current state of information literacy among SGC faculty? What is the optimal state of information literacy among SGC faculty? For those faculty members who are information literate, what technology are they using to demonstrate information literacy in their instruction? For those faculty members who do not use technology for gathering and presenting data in their course instruction, what are the reasons for why they do not? How can those who are not information literate be brought up to proficiency? How can those who are information literate help those who are not?

Methods

South Georgia College consists of 41 faculty members from various academic backgrounds. Only full-time, teaching faculty members from the major academic divisions on campus were considered as subjects for research. All academic faculty members were asked to complete a survey. Six faculty members, two from each of the four major divisions on campus, were randomly selected and asked to participate in an interview. Those divisions included the Division of Humanities and Learning Support, Division of Business and Social Sciences and Division of Science and Mathematics.

The two instruments used to conduct research were in-depth interviews and a closed-ended survey. The closed-ended survey consisted of general questions designed to validate the issues, needs and causes of the needs assessment. In other words, the survey asked objective, general questions concerning the perceived current and optimal levels of information literacy among SGC faculty, the needs of those who are information literate and the needs of those who are not, and the causes for why a gap exists between the current and optimal levels of information literacy among the faculty. The in-depth interviews were conducted after the surveys were tallied. The interviews focused on gathering subjective data from participants. The interview questions dealt mainly with measuring the gap between the current and optimal levels of information literacy among SGC faculty, identifying areas of concern for those faculty who are using technology as well as for those who are not, and soliciting support from those faculty members who are information literate to help bring those who are not up to task.

The procedures for developing and conducting research consisted of several steps. First, permission from the Vice President of Academic Affairs to conduct research on the campus of South Georgia College was obtained. Each interview subject signed a written consent form before participating in this study. Finally, permission from the VSU Institutional Review Board for the Protection of Human Subjects in Research and Research Related Activities was obtained before carrying out this needs assessment.

Next, the standards used to represent the optimal level of information literacy among SGC faculty were developed. These standards were adopted from the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education (ACRL, 2000). Although these standards and performance indicators are relative to the students of higher education, they also apply to teachers of higher education since it is the teachers who must teach the students how to be information literate. Thus, the Faculty Information Literacy Standards for assessing the optimal level of information literacy among SGC faculty were designed from those proposed for students by the ACRL. Those standards include the following - Standard I: The information literate teacher determines the nature and extent of the information needed; Standard II: The information literate teacher accesses needed information effectively and efficiently; Standard III: The information literate teacher evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system; Standard IV: The information literate teacher, individually or as a member of the a group, uses information effectively to accomplish a specific purpose; and Standard V: The information literate teacher understands many of the economic, legal, and social issues surrounding the use of the information and accesses and uses information ethically and legally. The specific objectives that accompany each benchmark are those same objectives that can be found on the ACRL's web site for the student Information Literacy Competency Standards for Higher Education.

After gathering research, the data from the interviews was compared to these standards to assess which faculty members are information literate and which are not. Each subject's interview was rated to determine how information literate those faculty interviewed were on a scale of one to five, one being "Optimal Level of Information Literacy" and five being "No Level of Information Literacy."

After the standards were set for assessing the optimal level of information literacy, the instruments were designed and developed. The in-depth interview questions were developed from a sample interview outlined in Chapter 3, Appendix B, of *The User-Friendly Handbook for Mixed Method Evaluation.* The closed-ended survey was developed from the format of a sample instructor evaluation used by the Division of Business and Social Sciences at South Georgia College.

The first instrument distributed was the closed-ended survey. Through campus mail, it was delivered to all fulltime, academic faculty members. The survey focused on more general and objective data that pertained to the information literacy perceptions of all faculty members from the various academic disciplines on campus. A memo from the Vice-President of Academic Affairs accompanied the survey, asking all faculty to participate in this research endeavor. A statement at the top of the survey explaining the purpose of the research ensured that the subjects knew the validity and confidentiality of the data retrieved. Each subject was asked to complete the survey and return it once they had answered all the questions. The data from all surveys were tallied using an Excel spreadsheet.

Six faculty members, roughly 15% of the faculty population, were randomly selected to interview. One interviewee was from each of the following academic areas: mathematics, sciences, Humanities, learning support, business and social sciences. Before administering the interview, each participant completed a consent form so they fully understood the confidentiality of the interview. All interviews but one was tape-recorded. The interviews were not documented verbatim, but rather documented through the "note expansion" method of data collection. The tape recordings were only used for clarity and backup. The data from all interviews were complied using a spreadsheet in Microsoft Excel.

The information found from the survey was complied using the program Microsoft Excel. First, all responses from the survey were entered into an Excel spreadsheet. Each survey question was typed into the spreadsheet with each subject's response listed in columns running along side the corresponding questions. The closed-ended questions on the survey easily allowed the options of "Strongly Agree," "Agree," "Disagree," and "Strongly Disagree" to be translated into a scale of one to four, one representing "Strongly Agree" and four representing "Strongly Disagree." After the surveys were conducted, a rating of five, which stood for, "Don't Know," was included since some participants wrote this answer in. The ratings for each question were averaged, establishing an overall rating for each question.

The data collected from the interviews were compiled and analyzed in much the same way as the survey. The interview questions were documented in a spreadsheet and all responses from those interviewed were typed into columns running side-by-side next to the corresponding question. This allowed for the answers given to a particular question to be seen at once for easy comparison to the standards. Each interview was rated on a scale of one to five, one representing "optimal level of information literacy" and five representing "no level of information literacy." Finally, the overall rating for each interview was averaged to find the mean of all the interviews. This helped establish an information literacy rating for the entire faculty. This information was then compared with the results found from the survey data. Our hypothesis was that the general consensus of the survey would match the subjective observations of the interviews to provide an objective conclusion concerning the optimal and current levels of information literacy among the faculty of SGC.

Results

Out of all surveys administered, 18 were returned. The responses of the surveys were tallied and the results placed in an Excel spreadsheet. Each subject's response was tallied according to a rating; then each question received an average rating that allowed us to conclude our results.

Several intriguing results surfaced, as did a few problems in the design of the survey questions. On questions one (Information literacy is the ability to recognize when information is needed, then locate, evaluate and use that information effectively to fulfill the need. Given this definition of information literacy, at least 60% of SGC faculty are information literate.), two (Given the definition of information literacy stated above [in question one], you consider yourself to be information literate.), seven (All academic information obtained from the Internet does not need to be considered under copyright; it is available for all to use freely.), and nine (Faculty members who do not demonstrate information literacy in their course curriculum should attend workshops or activities to learn how to do so.), we received the expected outcome that we had hoped for. We had hypothesized that an average of the participants would have agreed that the majority of his or her colleagues, as well as him or herself, were information literate. We had also expected that an average of the participants would have disagreed on the issue of all academic information obtained from the Internet not being considered under copyright. Finally, we also anticipated that the average answer would be, "Agree," when the participants were asked if faculty members who are not information literate need to attend workshops or activities to learn how to become information literate.

The other questions proved to have differing results from what we had expected. Question three asked participants if multimedia, electronic databases, and web sites were the primary media used by faculty to demonstrate information literacy in their course curriculum. The average answer was "Disagree." We concluded that this finding suggests faculty members still prefer traditional printed resources to gain information, probably because most still use lesson plans that were developed before electronic resources were popular or available. This finding concurred with the results of our interviews as well. However, our results from question six (The first place you would look to find supplemental information on your academic subject would be to obtain printed materials, such as books, journals, and magazines, from the school library.) showed that "the tides are beginning to turn." The average answer to this question was, "Disagree." This means that the first place faculty would look for finding supplemental information is not traditional printed resources but rather non-traditional resources, e.g. electronic resources. As for whether they would recommend a web site to their students as the first place to find supplemental material for the course, question eight, the average response was barely "Agree" – 2.44. This proved that some teachers would have immediately recommended a web site and others would not have done so.

Questions four and five yielded a great deal of controversy since several people wrote in answers of, "Don't Know," or "Problematic question," rather than answering. We believe that this confusion on question four - which asks if a faculty member uses on-site library and printed resources in his or her instruction, he or she is information literate - could have resulted from a design flaw in the survey. Participants may have thought from the previous three questions that information literacy only deals with technology. If question five - combining both printed and electronic media to yield the most information literate teacher - had come before question four, we believe more accurate results would have emerged for question four.

The greatest design flaw that we found from the survey was that several participants answered, "Don't Know," to questions one, three, four, and seven. These questions asked the participant to answer based on generalizations concerning the entire faculty. We felt that because Academic Freedom is highly upheld in post secondary education, those participants who answered, "Don't Know," did not want to guess at what their colleagues did in their classrooms because they truly do not know. The questions should have been reworded to ask the participants what they did in their own course instruction, not to generalize for the entire target population. This held true for all these questions except question seven. Subjects responded, "Don't Know," to this question because they truly do not know the laws and ethical standards associated with copyright on the Internet.

The most significant discovery from the survey results was that the average answer for question ten - whether or not those teachers who are not information literate would become more information literate if they had better access to technology – was, "Disagree." This showed that most of those faculty members surveyed believe that even if specific technology were made available, a teacher would either continue to rely on traditional means of information gathering or that technology has no effect on how information literate one is.

The interviews were conducted within the span of one week. The following questions were asked of each participant - Question one: What types of resources do you use to gather information? Question two: How do you use technology to gather information? (If you do not use technology to gather information, why not?) Question three: Do you think a teacher's use of technology in course instruction reflects knowledge of information literacy? Why or why not? Question four: What methods of information retrieval are best suited for your course instruction? Question five: What methods of information retrieval would you suggest to students for finding additional information for your course? Question six: What programs or activities do you think would help you become more information literate? Would technology be a part of those programs or activities?

The results from the In-depth Interviews supported some of the findings from the survey in greater detail. The average interview rating was 2.83, which ranked the average participant as being "Average Level of Information Literacy." We found that to be a very positive result from the interviews. However, two interviewees ranked as being, "Above Average," three ranked as, "Average," and one ranked as being, "Below Average." After having compared the participants' answers to the Faculty Information Literacy Standards devised for this needs assessment, we ranked them according to the rating scale. The main areas that kept some interviewees from ranking higher were in Standard I where they did not show that they used a variety of types and formats of potential resources for information, particularly electronic resources. For example, the three subjects who ranked "Average" drew most of their resources from printed information, such as library databases, reference books, and textbooks. Very few electronic resources were used by these three subjects for gathering information. Two participants showed competencies in all areas of the standards while one person only showed competency in one standard – Standard IV. Subject #3 did not use a variety of resources (Standard I), did not retrieve information online or in person using a variety of methods (Standard II), and did not compare new knowledge to determine the value added, contradictions, or other unique characteristics of the information (Standard III). He relied mostly on his textbooks for all information gathering. This type of observation is also seen in the survey results on a more general scale.

Only four of the Standards were used when comparing the participants' answers to the standards since none of the interview questions related to Standard V. This was a huge oversight on the part of the instrument designers. All other questions related to Standards I-IV, but no questions asked interviewees about their understanding of copyright or ethical use of information gathering. However, Subject #5 did volunteer that she would like to have programs or workshops to learn more about copyright laws as part of her answer to question six. This participant's interview rating was "Above Average Level of Information Literacy."

Several positive findings did emerge from the interviews, particularly in the answers to questions three and six. Most subjects answered question three with a clear understanding between being technology literate and information literate, even though technology literacy was not discussed by the interviewer. Question three asked whether or not a teacher's use of technology in course instruction reflects his or her knowledge of information literacy. A majority of participants stated, "Not necessarily," and went on to explain why. Subject #6 gave the best example, "For example, you may know how to use PowerPoint but not know how to find information on the subject for the presentation." This was one of the greatest discoveries from the interview results. Question six yielded a great deal of possible workshops or activities that could be implemented as part of the solution to this needs assessment.

Summary and Recommendations

The purpose of this needs assessment was to investigate the current and optimal levels of information literacy among SGC faculty members. In other words, a gap existed between how faculty members currently gather information and how they should be gathering information. The data collected and analyzed for this assessment showed how faculty members are gathering information. The Faculty Information Literacy Standards, adopted from the ACRL's Information Literacy standards, shows the assessors how SGC faculty members should be gathering information. We believe that from the data collected, on average, the faculty members at SGC are performing at an acceptable level of information literacy. However, several steps could be taken to help the majority of faculty members become even more information literate.

One possible solution was addressed in the In-depth Interview. Interviewees were asked what programs or activities might help them become more information literate and would technology be a part of those programs or activities. Several subjects said that conferences and workshops involving particular types of technology would certainly help them. For example, one person would be interested in further Galileo training, two would like to learn more about how to retrieve information from the web and research using the Internet, yet another would like to explore how online chats can be used to hear and write Spanish.

One workshop that was highly recommended is one that was posed by Subject #5 from the Interview – programs or workshops to learn about copyright laws on the Internet. From both the survey and interview results, this is one area of the Information Literacy Standards that the SGC faculty members do not know nor understand. Knowing copyright and ethical laws concerning what to use and how much of it to use from the Internet and World Wide Web in course instruction is certainly a paramount issue vis-à-vis information literacy. These workshops do not have to be expensive or lengthy in time. As Subject #6 suggested in his interview, brown bag workshops held during lunch could be provided on campus by librarians or those faculty members considered highly information literate to help bring others up to task. To encourage participation, door prizes could be given out at the beginning of the sessions or a brown bag lunch be provided by the school for those who do come.

Another inexpensive solution to bridging the gap between the current and optimal states of information literacy among faculty would be to hold periodical teaching circles in which a group of teachers from various disciplines come together once a month to discuss how they gather information and use it in their course instruction. This could also be done during a lunch hour in which the teachers go out to a favorite restaurant or bring a brown bag lunch. Not only would teaching circles promote information literacy, but it would also promote camaraderie among the faculty members. This would, in turn, provide a solid networking foundation for faculty members to pull upon each other as resources. It would also help expose all faculty members to a variety of up-to-date information search methods. This would be the most feasible solution to implement.

A third solution that would help teachers become more information literate at SGC would be for the administration to make the scholarship of teaching an even higher priority than what it is now. This could be relatively inexpensive for the school depending on the help from administrators and division chairpersons. The scholarship of teaching would deal with faculty members making a conscious effort to improve their course delivery methods and up-date their information literacy to make teaching a valid area of research. Through course instruction improvements, faculty members can begin to vie for specific grants and fellowships that reward those who excel in the scholarship of teaching. However, this will require that the administration support a faculty member's endeavors and provide him or her with the necessary means of improving course delivery. This could include buying or providing up-dated technology or paying for particular off-campus workshops or grant writing conferences.

In conclusion, a more in-depth needs assessment should be conducted in the area of information literacy at SGC. The needs assessment conducted here was extremely small in scale and uses instruments flawed in design. Although the majority of results obtained are valid, further investigation in this area would bring about more accurate results. Therefore, more information does need to be gathered, not only from the perspective of the faculty, but also from the perspectives of the administration and the students. If objective and thorough research is to be found, more subjects need to be interviewed and surveyed, and a wider variety of instruments need to be used for finding data.

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What Types of Online Facilitation Do Students Need?

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Abstract

The purpose of this study is to investigate facilitation in an online learning environment. The types of facilitation are examined using distance course students as subjects. Students' characteristics such as prior experience in distance courses, demographic attributes such as age, gender, and grades are incorporated as variables to explore their relationships with facilitation. This study first identifies major types of online facilitation that students requested in a web-based course. Then this study inspects whether students with different characteristics requested different types of online facilitation. Finally this study examines whether the amount of message requesting online facilitation is associated with learning achievement.

The participants of this study were 29 college students in a web-based course at a state university. The course requires students to actively participate in online activities and all course assignments are submitted as electronic files via the course site. Research data are the threaded messages that were posted by students, the instructor, and the TA in the designated areas in the course site. Threaded messages posted through entire semester are collected.

Five types of online facilitation were identified in this study. Findings and implications of findings regarding the relationships among types of online facilitation, student characteristics, and learning achievement were discussed. It was found that students requested more facilitation in assignments and grade criteria, and in network access. Different student characteristics were found to prefer different types of facilitation. Implication of this study for web-based course design and teaching was then suggested.

Introduction

As more college courses are placed online, effective instruction tools of online courses has become one of key issues of investigation. Among the instruction tools adopted in online courses, facilitation is a variable less studied. The purpose of this study is to explore facilitation as an effective instruction tool and examine the relationships among types of online facilitation, student characteristics, and learning achievement. Students taking online courses tend to learn alone in front of their computers and are distant from their instructors or classmates both physically and psychologically. Therefore, they need assistance in solving problems such as accessing to course materials in course site or in clarifying expectations of assignments online. The instructor or student peers may respond to a student's request so the student can learn to get what he needs online. Therefore, facilitation is even a more important factor in scaffolding learning in web-based environments as compared to the traditional classrooms. However, very few existing studies have looked into the nature of facilitation in online learning environments. This has presented a research opportunity for this study to explore types of facilitation and variables affecting facilitation.

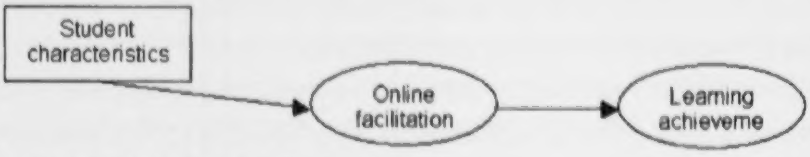

Figure 1. Relationships examined in this study

The findings of the study will provide new insight into designing and teaching web-based courses. Specifically, the study identifies types of online facilitation and suggests that both web-based course designers and instructors should pay more attention to some particular types of facilitation that students requested more often. The findings also suggest that different students may require different amount of facilitation.

Literature Review

Online Facilitation

In online learning environments, on-line facilitation has been proposed in previous studies as an effective pedagogical strategy to increase interaction and, then, to enhance learning achievement. Althaus (1997) studied the effects of computer-mediated discussion (CMD) on learning achievement. He recommended providing facilitation in order to encourage students to participate in CMD, especially those students who lacked online skills. Hmelo, Guzdial, and Turns (1998) investigated the effect of an online forum for collaboration and reflection in the Collaborative and Multimedia Interactive Learning Environment (CaMILE). The authors suggested that some forms of online facilitation were needed either to provide a logical connection between student activities and conceptual topics or to provide the concrete referent that was needed for reflective discussion. Furthermore, Garland (1993) inspected students' perceptions of barriers in completing distance courses. To overcome these barriers, she recommended providing adequate facilitation to students in terms of more communication. Although online facilitation has been suggested as an effective pedagogical strategy by many researchers, it is unclear that whether online facilitation is equally effective in different student demography.

Student Characteristics

Student characteristics have been predicted to have impact on learning outcomes. Major student characteristics investigated in computer-aided or online learning environments are prior experience in similar learning environments, personal attributes, and learning achievement. As to prior experience, previous studies suggest that prior experiences in using computer are positively related to academic achievement. Althaus (1997) found that students who had more e-mail experience were more willing to participate in Computer-Mediated Discussion (CMD), and students who fully participated in CMD performed better than others who participated less. Grantham and Vaske (1985) found that the amount of prior experience in e-mail was positively associated with telecomputing use. Hiltz (1993) concluded that students' comfortableness with computers was one of the major characteristics that would lead to better learning in computer-aided environments. Also, Harris and Grandgenett (1996) found that telecomputing experience was positively related to greater online time, and greater online time could lead to higher achievement.

The consistent positive association between prior experience in using computer and more efforts on online learning may imply that students who have no experience in distance learning may need more facilitation to assist them. But, there are few studies examining the relationship between the need for facilitation and prior experience.

Regarding student's personal attributes such as gender and age, there is little research that studies how personal attributes affect the need for facilitation. Previous studies, investigating learner characteristics and computer anxiety in computer-aided learning environments, suggest that such a link may exist. High computer anxiety students may need more facilitation to reduce anxiety level. However, previous studies on computer anxiety showed inconclusive results concerning the relationship between personal attributes and computer anxiety.

A meta-analysis of 81 studies reported that computer anxiety was not significantly correlated with gender and age (Rosen & Maguire, 1990). But, another study reported that feminine-identity students showed higher anxiety than masculine-identity students did (Rosen & Sears, 1987). Other studies also reported significant correlation between computer anxiety and age. In one study it was reported that older adults (55 years old and over) appeared to have less computer anxiety than younger adults (30 years old and under) did (Dyck & Smither, 1994). However, in other studies it was reported that older students were more computer anxious than younger students (Rosen, Sears, & Weil, 1987; Jones & Wall, 1989). Five studies of over 450 college students compared the computer anxiety of computer and business major students with that of other major students and found that computer anxiety consistently correlated with students' majors (Rosen, Sears, & Weil, 1987).

Learning Achievement

While previous studies addressed very little about the relationship between online facilitation and learning achievement, some studies examining the relationship between computer anxiety and learning achievement. A study explored components of computer anxiety and found there was no significant relationship between anxiety and students' academic achievement in the computer course as measured by their course grades (Jones & Wall, 1989). Although computer anxiety may be viewed as an indicator to the need for online facilitation, it is hard to draw any conclusion without more studies. Thus, this study is devoted to investigating the relationship between learning achievement and online facilitation.

Method

Participants

The participants of this study were 29 college students, 21 females and 8 males, who enrolled in a web-based course at a state university. 14 participants majored in Open Distance Learning and 15 participants in other degree programs. Participants' ages are 19 and above. All 29 participants were voluntarily participated in this study.

The Course

This study was conducted in a course that was entirely delivered via a web-based course site. The course title was Learning Theories and Cognition in Instruction and was offered by the College of Education at a state university in the southeast of the United States. Students were required to submit all assignments electronically via the course site. Also online participation in activities was mandatory. The final course grade consisted of four assignments (60%) and online participation (40%).

Three designated areas in the course s ite were created for students to post requests for facilitation. These areas were Online Office, Student Lounge, and Information Sharing (Figure 2). Students were encouraged to post messages in these areas for asking extra assistance, raising questions, expressing concerns, and sharing information with the class. The instructor, the teaching assistant (TA), and students might respond to messages in these areas. Also, the instructor and the TA might also respond in the Announcements area in the course site (Figure 3).

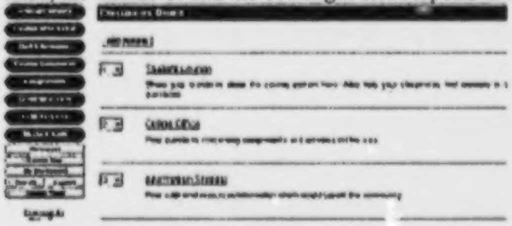

Figure 2. Online Facilitation Areas

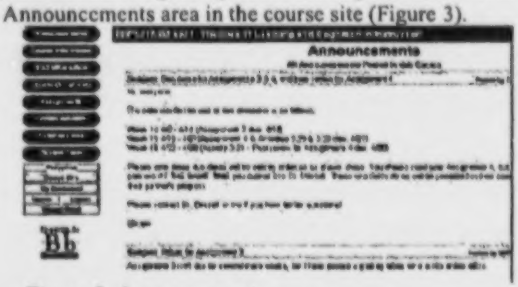

Figure 3. Announcements

Data collection and Analysis

Research data were the threaded messages that posted by students, the instructor, and the TA in the Online Office, Student Lounge, Information Sharing, and Announcements areas in the course site. These data were collected through an entire semester. In the beginning of the semester, a survey, which collected the information of students' demography, personal particulars, and prior experience in distance courses, was filled by participants.

First, based on the senders of messages, messages were classified into two categories: requesting for facilitation and responding to requests. Then, based on the content of questions or responses in the message texts, these messages were further classified into different facilitation types within each category. Total frequencies of requesting facilitation and responding to requests were tallied. Finally, cross tables of facilitation type, student characteristics, and learning achievement were generated.

Results

Types of Online Facilitation

Five types of online facilitation were identified from the content analysis of the threaded messages as posted by students in the course site. The total number of request messages, which requested for facilitation, was 33. These five facilitation types with descriptions are listed in the following:

1. Assignments and grades: Messages that asked questions about due dates, the instructor's expectation, grading criteria of assignments, and course grades
2. Network access: Messages that asked questions about the access to WWW network and online course materials in the course site
3. Online discussion: Messages that asked questions about clarification, reflections, and suggestions of online discussion
4. Group activities: Messages that asked questions about group activities

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5. Other course materials access: Messages that asked questions about the access to the textbook, study guide, the university, and local libraries

The results indicated that the most requested type of facilitation was Assignments and grades, which included 13 messages and represented 39% of total messages that asked for facilitation. The second most requested type of facilitation was Network access, which included 11 messages representing 23% of total messages that asked for facilitation. See Table 1 for the frequency of messages that requested online facilitation in each facilitation type.

There were 85 response messages that responded to the request messages. Based on the persons who responded, the messages were sorted into three categories: instructor, TA, and peer. Peer responses were the highest responses in all five facilitation types. Peers responded 54 messages, which consisted of 64% of total responded messages. The instructor and TA responded 16 and 15 messages and consisted of 19% and 18% of total response messages, respectively. See Table 1 for the frequencies of response messages from the instructor, TA, and peer in each facilitation type.

Student Characteristics and Online Facilitation

Experience in distance courses. There were 33 request messages posted by 24 experienced students and 0 messages posted by 5 non-experienced students. The average number of messages was 1.38 per experienced student and 0.00 per non-experienced student.

Table 1. Types of facilitation that students need in a web-based course

Facilitation Type	Frequency**	Responded by***			Total Responses
		Instructor	TA	Peer	
Assignments & grades *	13* (39%)	10 (25%)	8 (20%)	22 (55%)	40
Network access*	11* (33%)	0 (0%)	2 (7%)	26 (93%)	28
Online discussion	5 (15%)	5 (50%)	2 (20%)	3 (30%)	10
Group activities	3 (9%)	1 (17%)	3 (40%)	2 (33%)	6
Other course materials access	1 (3%)	0 (0%)	0 (0%)	1 (100%)	1
Total	33	16 (19%)	15 (18%)	54 (64%)	85

*The most needed two types of facilitation **Percentage of total frequency***Percentage of total responses

Gender. Among the 33 messages requesting for facilitation, 27 messages were posted by 21 females and 6 messages were posted by 8 males. The average number of messages was 1.29 per female and 0.75 per male.

Age. There were 13 messages posted by 17 younger students (age 19 – 35 years) and 20 messages posted by 12 older students (age 36 and above). The average number of messages was 0.76 per younger student and 1.66 per older student.

Major. There were 29 messages posted by 14 students of Open Distance Learning major and 4 messages posted by students of other majors. The average number of messages was 2.07 per student of Open Distance Learning major and 0.27 per student of other majors.

GPA. In order to have similar number of students in each cluster, GPA was classified into three clusters: low GPA (3.0-3.69), medium GPA (3.70-3.99), High GPA (4.00). There were 16 messages posted by 11 high GPA (4.00) students, 17 messages posted by 9 medium GPA (3.70-3.99) students, and 0 messages posted by 8 low GPA (3.00-3.69) students. The average number of messages was 1.45 per high GPA student, 1.89 per medium GPA student, and 0.00 messages per low GPA student. Table 2 lists the amount and average of messages that requested facilitation under each student's characteristic.

Table 2. Student Characteristics and Online Facilitation

Student Characteristic		Total number of students	Total frequency of requesting facilitation	Average Frequency per student
Experience in distance courses	No	5	0	0.00
	Yes	24	33	1.38
Gender	Female	21	27	1.29
	Male	8	6	0.75
Age	Younger (age 19-35)	17	13	0.76
	Older (age 36 and above)	12	20	1.70

Major	Open Distance Learning	14	29	2.07
	Other majors	15	4	0.27
GPA*	Low (3.0-3.69)	8	0	0.00
	Medium (3.70-3.99)	9	17	1.89
	High (4.00)	11	16	1.45

*There is one datum missing in GPA.

The Most Needed Facilitation Type within Each Student Characteristic

The most requested facilitation type within each student characteristic was analyzed. Overall, the results showed consistently that the most requested types of facilitation were: 1) Network access, 2) Assignments and grades. However, further observation reveals that the most requested facilitation may differ in different student characteristics. It can be observed that students with prior distance learning experience needed facilitation in assignments and grades the most, while non-experienced students desired facilitation in network access the most. The most needed facilitation for female students was assignments and grades, whereas for male students was network access. While younger students (years 19 – 35) needed facilitation in assignments and grades the most, older students (years 36 and above) requested facilitation in network access the most. Open Distance Learning majors needed facilitation in network access the most, and other major students desired facilitation in assignments and grades the most. Both high and medium GPA students needed facilitation in network access the most. However, low GPA students did not request any facilitation. See Table 3 for the most needed type of facilitation in each learner characteristic.

Table 3. The Most Needed Facilitation Type by Student Characteristic

Student Characteristic		Facilitation Type
Experience in distance learning	No	Assignments & grades
	Yes	Network access
Gender	Female	Assignments & grades
	Male	Network access
Age	19-35	Assignments & grades
	36 and above	Network access
Major	ODL	Network access
	Other majors	Assignments & grades
GPA	Low (3.00-3.69)	None
	Medium (3.70-3.99)	Network access
	High (4.00)	Network access

Learning Achievement and Online

The final course grade was categorized into three clusters: low grade (2.19-3.46), medium grade (3.47-3.82), and high grade (3.83-4.00) with each cluster having similar number of students.. The total number and the average of the messages that requested facilitation in each cluster of the final course grade are listed in Table 4. Table 4 shows that low-grade and high-grade students posted an average of 1 message per person while medium grade students posted an average of 1.4 messages per person.

Table 4. Learning Achievement and the Amount of Online Facilitation

Final Course Grade	Low (2.19-3.46)	Medium (3.47-3.82)	High (3.83-4.00)
Total number of students	10	10	9
Frequency of requesting facilitation	10	14	9
Average Frequency per student	1.00	1.40	1.00

The average of request online facilitation, then, was calculated under each student characteristic within each cluster of the final course grade. The results showed 0 message posted by non-experienced students in all grade clusters. The result also showed similar averages of messages posted by experienced students in all grade clusters, 1.25, 1.56 and 1.29 messages per experienced student for low, medium, and high-grade students, respectively. For female students, medium-grade students posted the most (1.43) messages per student, and for male students, the high-grade students posted the most (1.50) messages per student. For younger students, high-grade students posted the most (1.50) messages per student; and for older students, medium-grade students posted the most (2.00) messages per student. For Open Distance Learning students, medium-grade students posted the most (3.25) messages per student; and for other major students; low-grade students posted the most (1.67) messages per student. The results showed 0 message posted by low GPA students in all grade clusters. For medium GPA students, low-grade students posted the most (3.33) messages; and for high GPA students, medium-grade students posted the most (2.00) messages.

Overall, The result showed that among experienced, female, older, Open Distance Learning major, and high GPA students, medium-grade students requested more facilitation than either low or high-grade students. The result also showed that among other majors and medium GPA students, low-grade students requested more facilitation than either medium or high-grade students. In addition, the result showed that among male and younger students, high-grade students requested more facilitation than either low or medium-grade students. Table 5 lists the average of request online facilitation by student characteristics within final course grade clusters.

Table 5 The Average of Request Online Facilitation by Student Characteristics within Grade Clusters

Final Course Grade Request Facilitation Student Characteristic		Low (2.19-3.46)	Medium (3.47-3.82)	High (3.83-4.00)
DL Experience	No	0	0	0
	Yes	1.25	1.56	1.29
Gender	Female	1.14	1.43	.0.86
	Male	0.67	1.33	1.50
Age	Younger (19-35)	1.14	1	1.50
	Older (36 and above)	0.67	2.00	0.60
Major	Open Distance Learning	0	3.25	1
	Other majors	1.67	0.17	1.00
GPA	Low (3.0-3.69)	0	0	0
	Medium (3.70-3.99)	3.33	1.33	1
	High (4.00)	0.00	2.00	1.20

*DL experience: experience in distance learning

Discussion

Types of Online Facilitation

Five types of online facilitation were identified. They were, in the order of descending frequency of request: 1) Assignments and grades 2) Network access 3) Online discussion 4) Group activities 5) Other course materials access. This result suggests that from students' viewpoints the most desired facilitation is assisting them to complete the assignments and to obtain high grades. The second most needed facilitation is the assistance in network access to course materials and participating in the activities in the course site.

This finding of assignments and grades as the most needed type of facilitation shows strong implications in web-based course design and teaching. For web-based course design, instructional system designers should make the description of assignments and grading criteria particularly clear so that it can thoroughly communicate with students about the expectations of the course. For web-based course teaching, although the descriptions of assignments and grading criteria may be clearly stated in the course site, students may overlook them. Instructors should instruct students to the location of specific pages or even demonstrate to students how to access to this particular information containing assignments and grading criteria in the course site.

The implication of this finding concerning network access as the second most requested type of facilitation is that both web-based course designers and instructors should take students' computer literacy into consideration while designing and teaching web-based courses. Although telecommunication technology is very promising most of the time, it seems also very discouraging sometimes. Network disconnection occurs irregularly if not frequently in everyday practice. There are so many factors that may affect the network connection and, consequently, may cause communication barriers between students and instructors. Some of these problems may not be controllable or fixable by students. Flexibility of schedule should be built within web-based course design. Due dates of assignments and activities should not be too rigid in order to allow time for solving unexpected telecommunication problems. Instructors should seek prompt support from the system support team, who is responsible for the course delivery system, so that any telecommunication problems can be solved as soon as possible.

Response Messages

About two thirds (64%)of the total response messages was posted by students, while the instructor together with the TA provided about one third (37%). This finding implied that peers contribute a great deal of facilitation. The willingness of providing help among peers in this web-based learning environment appears to be strong. This result suggests that interaction among students plays an important role in distance learning environments. Peer interaction should be included as an essential instructional strategy in web-based course design. Web-based course instructors should build rich learning communities in course sites and encourage students to actively provide facilitation to peers.

Student Characteristics and Online Facilitation

The most important finding from this study was that all 33 messages that request for online facilitation were posted by experienced distance students. In contrast, no message was posted by non-experienced distance students. The reason why this result produces such a strong contrast may be because experienced students know how to request online facilitation whereas non-experienced students may not know. Although it is speculated that non-experienced students may need and request more facilitation than experienced students do, the data seem not able to support such a speculation. The data can only be explained by the fact that non-experienced students have problem learning to use online communication tools to express their needs for online facilitation. The online tools of communicating via the course site are new to non-experienced students and they may be less comfortable in using these new tools.

Although this finding indirectly supports previous findings that experienced students spend more time online than non-experienced students do (Vaske, 1985; Hiltz, 1993; Grandgenett, 1996; Althaus, 1997), the hypothesis that non-experienced students will request more online facilitation was not supported in this study. How to reveal the need for online facilitation from non-experienced student will be an important research challenge in the future.

The average frequency of requesting facilitation is higher in females (1.29 per female) than in males (0.75 per male). If requesting for facilitation is an indication of anxiety, this finding indirectly supports previous studies that feminine-identity students were found to appear more computer anxious than masculine-identity students do (Rosen & Sears, 1987). Given that existing studies involving gender effects in computer-related learning have produced inconsistent findings, this finding of significant gender effects should be considered as tentative. Further research in examining the relationship between learner's gender and the need for online facilitation is still needed.

The average number of messages posted by older students (1.70 per student) to request for online facilitation was higher than those posted by younger students (0.76 per student). This finding supports some studies that older students are found to be more computer anxious than younger students (Rosen, Sears, & Weil, 1987; Jones & Wall, 1989).

The average number of messages posted by Open Distance Learning major students (2.07 per student) was higher than other major students (0.27 per student). This finding indirectly supports a previous result that computer anxiety consistently correlated with students' majors (Rosen, Sears, & Weil, 1987). Once again that further research is desired for directly addressing the relationship between student's major and the need of online facilitation.

The average number of messages that requesting online facilitation posted by high and medium GPA students (1.45 per high GPA student, 1.89 per medium GPA student) were higher than low GPA students (0.00 per low GPA students). Low GPA students did not even request any online facilitation at all. They seem either not know how to request facilitation or have low learner motivation to solve problems that are pointed out in the online messages. This finding may suggest that the learner motivational factors should be built in both web-based course design and teaching. If the web-based course design can gain and sustain students' attention to the focus of the course contents, enhance relevance between course contents and the learners' concerns, build students' confidence about themselves, and generate students' satisfaction about the course, students may be more motivated to solve problems and to request necessary facilitation.

The Most Needed Facilitation Type within Each Student Characteristic

The finding indicated, for each student characteristic, the most desired facilitation type was either network access or information of assignments and grades. Further data analysis reveals that, on one hand, female, younger, other majors, non-experienced, and medium and high GPA students requested facilitation in assignments and grades the most. On the other hand, male, older, Open Distance Major, and distance learning experienced students needed facilitation in network access the most. Female, younger, other majors, non-experienced, and medium and high GPA students may be less sure about their learning achievement, so they are more concerned about assignments and grades. On the contrary, male, older, Open Distance Major, and distance learning experienced students have more confidence on their online skills but may need more help in fully utilizing online resources. Such a difference in facilitation preference between student characteristics deserves further study to provide more explanation.

With respect to grades, this study found that low GPA students did not even request any facilitation. The possible explanation is that low GPA students may not have enough motivation to learn.

Overall, the implication of the above findings is that, from students' viewpoints, assignments, grades, and network access should be the central foci of web-based courses. Expectations of assignments, grading criteria, and the guidelines of course site access should be well stated in course sites and thoroughly communicated with students by the instructor.

Learning Achievement and Online Facilitation

The result showed that among experienced, female, older, Open Distance Learning major, and high GPA students, medium-grade students requested more facilitation than either low or high-grade students. It implies that if low-grade students had requested sufficient facilitation, they may achieve better grades. High-grade students may already have the ability to learn by themselves without much facilitation.

The result also showed that among other majors and medium GPA students, low-grade students requested more facilitation than either medium or high-grade students. This finding indicates that other majors and medium GPA students have experienced learning difficulties in the course. It not only suggests that web-based instructors should provide more facilitation to other majors and medium GPA students, but also propose a further research question – what kind of difficulties that other majors and medium GPA student may have experienced and how to assist them for better learning experiences.

In addition, the result showed that among male and younger students, high-grade students requested more facilitation than either low or medium-grade students. High-grade students may have stronger motivation to solve problems and concern more about learning achievement so they asked for more facilitation than low or medium-grade students do.

Conclusion

This study identifies five types of online facilitation requested by students. Among them, the two most requested types of online facilitation are 1) assignments and grades 2) network access. This study also makes suggestions for web-based course design and teaching. The following summarizes these suggestions:

1. Make due dates of assignments and activities flexible and explicitly clear
2. Thoroughly communicate with students about the expectations of assignments and grading criteria
3. Seek immediate supports from system support team to solve problems in the event that network access problems occur
4. Design instructional strategies emphasizing peer interaction in web-based courses and encourage peer interactions in teaching web-based courses
5. Employ learner motivational strategies in order to encourage low GPA students and non-experienced students to request facilitation online

The major limitation of this study is the small size of the research sample. There are 29 students participated in this study. With such a small number of participants and 3 to 5 categories in each variable to be analyzed, it is very difficult to employ statistical tests that will show meaningful results. Therefore, the findings from this study should be considered as tentative, and generalization from the conclusions of this study should be very limited.

A repetition of this study with larger sample size is recommended. With a large number of participants, sufficient data can be collected for statistical analysis in order to generalize meaningful conclusions.

More variables should also be incorporated to develop the concept of facilitation and better understand the nature of facilitation. It is still unclear that lack of online skills needs more facilitation or is just not able to post request for facilitation. It is also uncertain about the relationship between computer anxiety and request for facilitation.

Overall, this study identifies five types of online facilitation that students requested. Further research may be conducted to further verify these five types of online facilitation and to explore their relationships with learner characteristics and learning achievement.

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Listen to Me: Four Web-Based CSCL Students' Perspectives and Experiences in Group Collaboration and Knowledge Construction in Cyber Space

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Abstract

The main purpose of this Naturalistic inquiry study is to explore four ethnically diverse Web-based Computer Supported Collaborative Learning (CSCL) students' perceptions of and experiences in knowledge construction and group collaboration. Findings suggest that individual and group successes are interconnected and rely on successful negotiation and construction of shared knowledge among group members. While effective collaboration and knowledge construction among people of diverse backgrounds may be challenging, Web-based collaborative learning among similar populations may pose additional challenges than in face-to-face settings due to the absence or limited non-verbal communication cues. Educators interested in designing online courses for students of diverse backgrounds should not only consider the cognitive but also the social and cultural aspects of communication. Future studies should focus on exploring effective course design to facilitate both cognitive and social aspects of learning and to optimize individual as well as group learning.

Introduction

Assisted by technological advances, Web-based instruction is widely employed in preparing learners for "future responsibilities" and "success in life" (Dewey, 1938). To meet individual learner's needs while optimizing their strengths and talents, Confucius said, instruction should be tailored to meet individual learner's needs.

A plethora of distance-learning research studies have been conducted and Computer Supported Collaborative Learning (CSCL) has been one of the major focuses. However, most CSCL studies have addressed issues regarding tools, design, course impact, and evaluations from instructors', administrators', or instructional designers' observations. Few of these studies, however, have addressed these issues through the lenses of students. I became aware of the importance of studying human interaction (as opposed to focusing solely on technical functionality) from participating in the design of the CSCL course.

Conducted within the constructivist paradigm, this research focused on four ethnically diverse students' perceptions of and experiences in a computer-supported collaborative learning class where a major aspect of the course design was based on constructivist theory. The purpose of the study is to explore students' perspectives on group collaboration and knowledge construction in a CSCL class offered in Fall 2000 at University of Texas.

Naturalistic inquiry was employed as the research strategy for this study. Egon Guba referred to this inquiry method as the "constructivist inquiry. As described by Erlandson et al.(1993), naturalistic paradigm assumes that there are "multiple realities;" affirms the "mutual influence that researcher and respondents have on each other;" and assumes that "total generalization is never possible."

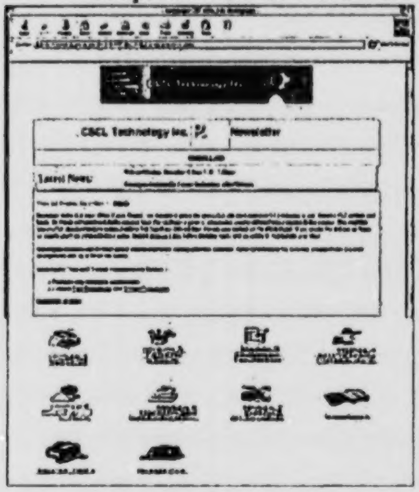
In order to avoid framing interviewees, this study was guided solely by one focus question, "How did you perceive the group collaboration and knowledge construction work in your CSCL 2000 class?" Group collaboration and knowledge construction were focused upon because they were the two essential course objectives.

Study Context

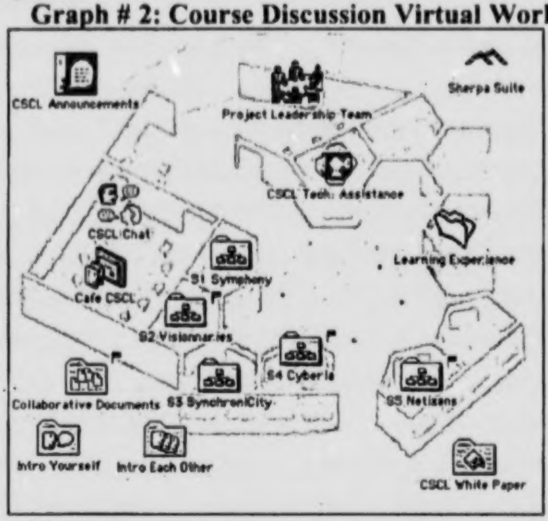
CSCL is derived from CSCW (Computer Supported Collaborative Work), which was named after "Office Automation" (a system that aimed at facilitating businesses for efficient and effective work). The main differences between CSCL and CSCW are their contexts and purposes. CSCW focuses on getting work done and is mainly employed in business settings where sectors, departments, and companies collaborate to complete projects and make decisions. CSCL focuses on learning and is employed in educational settings where collaborators in the learning community construct knowledge and accomplish joint projects. Resta, et al. (1999) said CSCL maybe used as the "catalyst for changing teacher practice" as teachers are "continually revising their curriculum design" based on their experiences and "emergent instructional needs" (p. 492). Such curriculum, rather than relying on a set plan to achieve predetermined outcomes, provides a platform for discourse and interaction between and among students, peers, and course-content experts. The CSCL curriculum enables knowledge construction and problem-solving among collaborators of diverse backgrounds. The instructors' role is transformed from that of a "sage on the stage," to that of a "guide on the side."

A major goal of this CSCL 2000 course was to assist learners to understand, create, and reflect through the engagement in projects similar to real-life. A variety of instructional material, resource links, and task instructions were available on the Web via WebCT courseware. The course content was divided into seven modules, a course handbook, a course tool page, and a resource link page (Graph #1). Each module contained tasks requiring learners to work both individually and collaboratively in completing tasks. Collaborative tasks included writing a topic paper, designing a tour in a MOO (Multi-user Object Oriented) virtual environment where users log onto a site to experience a text -based virtual reality environment, designing a WebQuest and working collaboratively with cross-team members to develop a final project utilizing a schedule planning tool for coordination (jointplanning.com). A WebQuest is an inquiry activity that is based on realistic and engaging tasks and the resources drawn by learners are from the Web. Its focus is on "using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation"(Dodge, Bernie).

Graph # 1: Course Web Site



Graph # 2: Course Discussion Virtual Works



Module One provided an overview of the course goals, objectives, required entry skills, technology requirements, course activity schedule, and other information helpful to the students in preparing to complete the course. Module Two provided opportunities for online socialization through introduction of the course mission, the online environment, and technological tools, while encouraging students to socialize with peers through a class-wide introduction activity. Modules Three, Four, and Five enabled students to exchange information and construct knowledge through online communication, search and exchange information, perform assigned tasks, and provided mutual support and cooperation among online team members. Students worked collaboratively to navigate and explore various network environments, utilizing collaborative tools to plan group projects, schedule meetings, negotiate tasks, develop ideas and concepts, make decisions, and edit finished projects as a group. Participants engaged in building a collaborative team, utilizing collaborative writing strategies, exploring synchronous online collaborative learning, and inquiring skills to develop a WebQuest, a Web-based activity that involves searching, reading, analyzing, and dialoging with peers to solve problems and create Web pages. The course handbook offered a virtual office tour, an organization chart about this virtual company, a directory of both students and staff, tips on working collaboratively, topics for collaborative work, and project examples.

To accomplish course requirements, online socialization and communication were essential. Extensive cooperation and collaboration among learners was necessary. A course discussion virtual workspace (Graph #2) offered students the opportunity to exchange information, discuss tasks, upload files, work collaboratively, and socialize both asynchronously and synchronously. CSCL Technology Company was employed as a metaphor to indicate a real world professional setting. Members of the class were divided into five virtual teams located in suites. There are two to three offices within each suite. Two to three students shared the same office and about six to seven students shared the same suite. Diversity (ethnic background, gender, and on-campus or tele-campus access) was considered when assigning students their suites at the beginning of the semester.

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There were five Webcasts (video-conferences) throughout the semester. On-campus students had the opportunity to attend on campus while tele-campus students attended through the Web. Additional modes of participation included telephone call-in and synchronous chat.

The product of the course was the accumulated contributions from learners through an emphasis on collaborative learning. Learners engaged in a variety of projects in order to understand the CSCL environment, create projects utilizing tools for collaborative learning, and reflect their own learning through personal journaling. Hence, course success resided completely on the students' success in collaboration.

Method

Naturalistic Inquiry

Naturalistic inquiry was employed as the research strategy for this study. Egon Guba (1981) referred this as the "constructivist inquiry." Guba pointed out that the "naturalistic inquiry is not equivalent to qualitative inquiry." Naturalistic inquiry utilizes "human instrument" – the researcher, with findings "created" through the interaction between the researcher(s) and participants (Erlandson, et.al., 1993 p. ix-xv). The naturalistic paradigm:

1. **Assumes that there are "multiple realities"** – While the Positivist view holds that there is a single objective reality, the naturalistic view assumes that "all the 'parts' of reality are interrelated.
2. **Affirms the "mutual influence that researcher and respondents have on each other"** – Naturalistic theorists asserts that "mutual simultaneous shaping" (the interaction between researchers and respondents) is unavoidable and the researcher must find ways to "control the biases that do not inhibit the flow of pertinent information (p. 15).
3. **Assumes that "total generalization is never possible"** – Unlike most scientific studies which seek to generalize findings, naturalistic inquiry seeks to include "thick description of one set of interrelationships in one social context" to allow "transfer of understanding" for readers across social contexts (Guba, 1981).

Guba, (1981) said that quantitative and qualitative methods can both be used in a naturalistic paradigm but qualitative research method is "generally preferred." He said that while "relevance" and "rigor" are both important, "relevance" is more important in the naturalistic paradigm. In the naturalistic paradigm, "emergent theory" is preferred," according to Guba. While all researchers use a variety of instruments to obtain data, in the naturalistic research, the "primary research instrument is the researcher" and is conducted in a "natural setting" rather than a "laboratory or controlled setting."

Constructivism

The philosophy behind the design of the CSCL course is Constructivism. The philosophy behind the design of the current naturalistic study is also Constructivism. Fosnot (1996) said Constructivism is a theory about knowledge and learning that explores both "what knowing is and how one comes to know." This theory, he said, describes knowledge as "temporary, developmental, nonobjective, internally constructed, and socially and culturally mediated." Constructivists view learning as a self-regulatory process in which learners constantly make meanings to construct and gain new knowledge and insights.

Jonassen (1994) identified the following elements of constructivist design: (1) multiple representations of reality, (2) representing the complexity of the real world, (3) emphasizing on knowledge construction instead of knowledge reproduction, (4) emphasizing authentic tasks in a meaningful context rather than abstract instruction out of context, (5) preferring real world settings to predetermined sequences of instruction, (6) encouraging thoughtful reflection on experience, (7) knowledge construction based on both content and context, (8) knowledge construction arrived at collaboratively rather than competitively.

As Duffy and Jonassen (1992) indicated, "Constructivism provided a very important vehicle for establishing the dialogue … the information age and the technological capabilities have caused us to re-conceptualize the learning process and to design new instructional approaches." (p. ix) Constructivists believe that "there are many ways to structure the world, and there are many meanings or perspectives for any event or concept. Thus there is not a correct meaning that we are striving for." (p. 3)

The study of human settings and interactions is a complex task. No two humans hold identical realities or experiences. It is my purpose to better understand what CSCL students have encountered, how they reacted or responded to certain situations, how they interacted with each other, what they perceived as worth knowing and learning, what particular incidences they perceived as worth discussing, and any other reflections they have had.

Participants

Purposeful sampling method to achieve as maximum a variation as possible within the study population was employeded in recruiting participants. As described by Merriam (1998), purposeful sampling is based on the assumption that the researcher wants to discover, understand and gain insight from participants. Therefore, selecting a sample that researcher can learn the most from is important (p. 48).

Study participants were recruited on a volunteer basis. This study focused on four female graduate students including a 47-year-old Caucasian, a 24-year-old Asian, a 36-year-old Hispanic American, and a 32-year-old Indian who were all enrolled in a graduate Web-based CSCL (Computer Supported Collaborative Learning) course offered in Fall 2000 at the University of Texas (UT) College of Education. These participants, registered through UT-Austin (on-campus students) and UT-Brownsville (Tele-campus students), participated in two interview sessions and numerous e-mail communications with the researcher from mid-October to mid-December, 2000.

Data Collection

For data triangulation, three data sources were obtained: transcripts of interviews; participants' concept maps and explanations; online course data; and transcripts of follow-up telephone or e-mail communications. Additional data were derived from the researcher's observation notes and the reflective journal. Primary data sources include interview transcripts, participants' explanations of their concept maps, and documents obtained directly from participants. Secondary data include online course data chosen by participants, researcher's transcript summaries, and researchers' observation notes and research journal.

Six students were initially requested to participate. Four students among the eight agreed to participate. These participants represented divergent levels of commitment in class as measured by students' online interaction and attendance from September 1st to October 1st 2000. Informed consent forms were sent to participants via e-mail with the request that they read the form carefully. The consent form that explained the purpose of the study, participation procedures and methods, study timeline, benefits and any known risks of participation, and estimated time involved in the two interview sessions and e-mail communications. The researcher collected and securely filed these forms for future reference.

Prior to the first interview, participants were provided the study focus question: "How did you perceive the group collaboration and knowledge construction work in your CSCL 2000 class?" The participants were ensured of their anonymity in the study and the right to withdraw at any time during the study; participants were continuously asked if they would like to add, delete, or make comments.

Participants were interviewed separately. To ensure that participants' stories remained the sole focus, I explained the basis of naturalistic inquiry prior to the interview, reminded them that their perceptions and experiences were the sole focus of my study, and assured them that they could express themselves freely. To assure that my understanding matched what they had hoped to express, I asked for clarifications and explanations. I asked them to expand and provide examples based solely in response to what they had said and refrained from framing their thoughts by using any pre-determined questions. Throughout the interview, I also summarized what they have said. This emergent interview method shared certain similarities with the active interview process described by Holsten and Gobrium (1995).

To further supplement my understanding, I sometimes drew pictures based on what participants were saying and used to check for clarity and understanding. Holsten and Gobrium discussed a goal of "creative interviewing" techniques as being "a set of techniques for moving past the mere words and sentences exchanged in the interview process." I made sure that the participants could "share their own thoughts and feelings" not only through words, but also symbols (p. 12).

Data Analysis

Naturalistic inquiry utilizes the researcher as "human instrument." The benefit of this is that data can be collected and analyzed non-linearly and interactively. In this study, data analysis occurred even during the interview. Two interviews per informant were conducted at agreed-upon locations, approximately 2-3 weeks apart. Each interview took approximately one hour. The interviews were audio-taped, transcribed, and organized into summaries. At first interview, participants were presented a printed version of their class online messages and were asked to select messages of their choice and explain the significance. During the first interview, participants expressed their perceptions and experiences based on the focus question and probing questions for explanation, expansion; examples were drawn from participants' responses. At first interview, each participant was asked to draw a concept map based on the focus question and to present this drawing at the second interview. The first interview summary was sent to participants prior to the second interview.

Interview tapes were first transcribed word-for-word. They were then unitized and coded from either words or phrases used directly by participants or from representative words for the unit information. Two types of coding methods were utilized for each interview transcript. The first method involved detailed frequency counting of particular ideas and subsequent grouping of these ideas into sub-themes. The second coding method was based on concepts that emerged. These two codes were then compared to discern cross-participants' shared themes. Six shared themes emerged and were defined based on the context.

Trustworthiness & Authenticity

Lincoln and Guba (1985) refer to trustworthiness and authenticity as two essential sets of criteria in constructivist research. Trustworthiness (the truth-value, or quality of the findings) refers to the validity and reliability of research issues. It ensures the research methods are correctly conducted. Authenticity refers to fairness, educative, and resulting actions arising from the research (p. 213).

Various methods are often employed to ensure "one has carried out the research process correctly" (Manning, 1997) and increase "the degree of confidence in truth" (Erlandson et al., 1993). The methods I employed to ensure trustworthiness included: writing a "researcher as" statement, purposefully sampling study participants, engaging with participants for an extensive period of time, obtaining more than one data source for data triangulation, forming a peer-debriefing group, and obtaining verifications of participants' interpretations.

To ensure authenticity in my study, informed consent was provided to participants prior to the first interview. In the consent form, participants were informed of the risks of and benefits from participation in the study, as well as their right to withdraw at any time. Prior to the interview, I explained to participants the nature of the study and their rights to freely express any opinions and concerns they may have.

Prior to conducting this study, I composed a "Researcher-as-Instrument Statement" that reflected upon the possible preconceptions or experiences that may possibly have influenced my conduct of this research. In this statement I stated that I was aware of my past notions regarding group work, my personality that may unconsciously influence my expectations and reactions, and my experiences with online learning that may be potentially create bias. Nevertheless, I stated that I expected to remain open and flexible to reassessment of any assumptions that may arise throughout the inquiry process. Cognizant of my interpretations that create sense of my world, I was equally cognizant of my duty to refrain from using words to "frame" participants during the entire research process. I stressed my research position to informants prior to interview. As a sherpa, I had the opportunity to extensively observe online activities, participate in a few group chats, and study the same course materials as all CSCL members. I observed and experienced participants' frustrations, confusions, stresses, and joys.

As suggested by Erlandson (1993), "The researcher should step out of the context being studied to review perceptions, insights, and analyses" (p. 31). Prior to forming my focus question, a peer-debriefing group was formed. The group composed of three peers who were knowledgeable of naturalistic inquiry and who shared similar interests in topics of inquiry. They helped me reconsider, refine, and revise my study, which added to the credibility of this study. We also read each other's transcripts, assisted in evaluating codes and themes during the data analysis process, read the draft version of the study, and provided feedback for revision prior to completion of the study. With their assistance, some decisions and actions were altered through insights gained. We provide each other with both task and emotional support. Often acting as devil's advocates, we met weekly to challenge and assist each other. Detailed minutes of the meetings were kept and served as a resource to be referred to during our inquiry processes.

To ensure that my understandings and interpretations were not biased, three levels of member checking were conducted throughout the inquiry process. The first member check was conducted during the interview process when participants were asked to clarify, explain, expand, and give examples. The second member check was conducted within a few days of each interview when participants were ask to verify the summaries of interviews transcripts. The grand member check was conducted after completion of case reports but prior to submission when participants were asked to confirm the final product. In addition, member checks were also conducted through informal conversations over the telephone and through e-mail. During the entire inquiry process, I also maintained a reflexive journal to record decisions made, reasons for those decisions, actions taken, questions that arose during the process, possible emerging patterns of analysis, and reactions to particular situations.

Findings

To ensure confidentiality, names and locations are changed to preserve the anonymity of the participants. The social relationships documented within remain true to life. The following cases are based on the data obtained from participants in Fall, 2000.

Participant information

Agnes, a 47 year-old Caucasian doctoral student, works part-time at a computer company. She was born and raised in America and has a theater and art background. She received her Master's degree in England. Although Agnes had a few small-scaled online collaborative learning experiences prior to entering CSCL 2000 class, she had never collaborated online.

Nancy, a 24 year-old Taiwanese master's student, works full-time at a primary school in Austin. She was born in Taiwan, but was raised in South America. She moved to America alone when she entered college. She is interested in Computer-Based Training and Assistive-Technology. She had one online collaborative learning experience prior to entering CSCL 2000 class but she thought it was a lot less intensive than this CSCL class.

Elizabeth, a 36 year-old Hispanic-American master's student, works full-time at a primary school in Austin as an Assistant Principal. She was born in Columbia and was raised in America. She is married with a kid and is expecting a baby in 6 months. She had some pervious online learning experience prior to entering CSCL 2000 class but have never collaborated online with a group of people. She said she has lots of opportunities to collaborate with colleagues in the face-to-face settings at work.

Angel, a 32 year-old Indian master's student, studies full-time at the University of Texas (U.T.), Austin. Fall 2000 is the first semester for her at U.T. and in America. She already received her Economics master's degree in India prior to entering U.T. and had worked as a high school teacher. She had no previous online learning experience and not much collaborative learning experience.

Emerged Themes Across Case

Six themes emerged through the process of data generation, analysis and comparison of participants: relationships; environment; communication; roles and identities; feelings; and personal variables. Emerged themes were listed in the order of importance as defined by the frequency being discussed.

Relationships

Relationship received the most attention among six emerged themes. For Agnes, group collaboration is a "process." Agnes' group had six people. "You are looking for connections with people," said Agnes. She thought that building relationships online was different because, "connection is often established one way." Agnes conceived that "interpersonal relationships" were important in the dynamics among her knowledge construction, group collaboration, and self-identity (as illustrated in her concept map, Graph #3).

Similar to Agnes, Elizabeth also emphasized much on relationships. During the interviews, Elizabeth repeatedly emphasized the importance of "being responsible for others." She said she did not want to "let down" her group mates. She thought if a person does not have "strong sense of responsibility for others" s/he would not succeed in class. Elizabeth thought it is important to build relationships and friendships in a collaborative learning class where members are held accountable for each other and they had to rely on each other in accomplishing tasks. She described her excitement at the beginning of the semester when she first "met" her virtual officemate online. "Every time I get online, I would check to see if she is there," said Elizabeth. She said the friendship she established with her officemate would last beyond the class.

Nancy and Angel also mentioned about relationships but not emphasized as much as Agnes and Elizabeth. Angel thought everyone has different needs for relationships. She thought that in a collaborative learning course like CSCL, learners are seeking both intellectual as well as emotional connections, however, when there are too many trivial tasks, students tend to just focusing on getting the tasks done rather than learning socio-emotional aspects of learning. Angel said that she was too busy trying to learn different tools and getting use to a new learning environment, she did not spend much time socializing with others.

Similar to Angel, Nancy did not perceive interpersonal relationships as important for her success in class. "The tasks are short, and they have no implications for the future," said Nancy. She said the relationship in class is temporal rather than long-term. Nancy thought interactions in temporal relationships are usually superficial rather than deeper understanding of each other. She thought that people usually react to things differently if they know they are going to have the work relationship for only a few months (a semester).

Communication

The second most discussed theme is communication. Agnes perceived that in online communication context, people do not "have a sense of each other as people." She said she had to "make efforts to individualize" her messages according to the different perceptions. Agnes saw herself as the "focus of the group" and her group did not "see itself" except in relation to her. She said she would intentionally "disappear for a while" so that her group would put her "in perspective again."

Agnes thought that an over-reliance on interpretations and assumptions may "mess us up in a terrible way" because in the online situation, they often "try to make meaning immediately by transferring facts and information and make assumptions." She said some classmates do not express much and they just use some "little symbols" to show their emotions and sometimes it is difficult to really know how they feel. As an example, Agnes recalled when she mistakenly thought a female group member was a man based on the name and the reason that she communicated more fact than emotions. Prior to confirming this "faceless" individual's gender, Agnes said she had perceived this team member as having a very strong personality and was not moved to confirm this person's gender until that person issued an apology which was not consistent with the image Agnes held for that person.

Elizabeth perceived positive feedback as an important method for online communication. She said she found herself transferring her communication style in real life to the online learning environment. She said because her role as an assistant principal at work, she often stressed the importance of "team spirit" and showed her appreciation, encouragement, supportive by giving personalized notes to her group mates via private mail. Elizabeth thought that people build relationships through communication and this relationship is reciprocal. "I may not go that extra mile for someone who I feel does not go that extra mile for the group," said Elizabeth. Similar to Elizabeth, Agnes also mentioned about the reciprocal communication, she thought asynchronous online interaction really lacks immediacy and intimacy.

Communication was Nancy's major focus among the six themes emerged across participants. Nancy thought the main difference between online and face-to-face collaborative learning was the "sharing of personal lives" and the chances for misunderstandings. She said limitations include: the need for clarifications seemed exponential; miscommunications seemed rampant due to individual interpretations and assumptions; group members seemed to lack an awareness of each others, communication methods seemed to have limitations; misunderstandings seemed to arise from missing cues (verbal, facial, and tone of voice); communication styles and skills seemed to vary widely among members; and communication tools seemed to present challenges of functionality.

Nancy recalled an example where her group was chatting online and some members of the group kept talking about football rather than tasks. As the team leader for that particular task, she tried to get their attention by typing, "Hello, there....!" Surprisingly, one of the group members said she was shouting and the other interpreted the situation as the "cultural gap." "It had nothing to do with culture, I understood what they were talking about and I have been exposed to football all my life, but let's just get back to the subject, will we?" said Nancy. "Everything you type in chat is in the middle of my conversation with the others," Nancy added. She said she did not want to spend many hours online chatting without getting tasks done and as the project leader, she felt responsible to keep the meeting effective and efficient.

Angel also mentioned about people misunderstood her but she said it is important to clarify and negotiate meaning. "It may take some time to get your message across or to understand what others have to say," said Angel. But she thought if everyone is sincere and sensitive to others' needs, the trust that build in the group will save a lot of time in later tasks. Similar to Nancy, Angel also observed different types of communication styles in this CSCL environment. They both mentioned that in the online environment, some people are more active while the others are more passive; some are assertive while the others just go with the flow; some feel more comfortable revealing their feelings while others do not reveal their personal lives in the online settings; some were formal while the others were very casual and made jokes or communicated with others through art forms.

Roles and identities

How members of the group identify themselves in the group affect how they act and communicate. For Agnes, knowledge construction and group collaboration are interrelate to herself as a person. Identity is "who I am to myself and what I would take with me no matter what," said Agnes. She said that there were "very strong identities" in her group and for any given collaborative projects, group members would "jump right in and grab" the tasks they prefer doing. Agnes thought it was good to rotate leadership role in collaborative teams, but guidelines for group leaders should be directed. She stressed that being "assertive" was one of the most important characteristics that online leaders should possess. She also said these leaders should be, "very organized," consistent; "responsible," and "active in participation," and one who "keeps others organized to a certain level."

Nancy said that roles and responsibilities within the group should be well-defined. "Collaboration should be done in a way that everyone knows their roles," said Nancy. Nancy said there were some "overlapping work and gaps" in her group. She thought that it is very important to "align people and their roles very carefully." Nancy said that in a group, "people are from different kinds of backgrounds" but "diversity works well only if everyone knew his or her roles and responsibilities" and if they have "positive attitudes." She said that a successful group should have strong leadership. Nancy recalled her experience being the project leader for one module and said one of the most challenging things was that "everyone's concept of time is different" and being at the forefront having certain responsibilities in "making sure everything is fine," she said it required certain skills. She said if a leader tried to "control" and hold "power" rather than "lead," then that person was "not doing a leader's job." Rather, the person was "doing authoritarian work." Similar to Nancy, Angel thought it was important to have well-defined roles and responsibilities. She said the course did not give clear guidelines because the course expect students to take turns performing leadership roles while everyone holds different concepts and expectations toward leadership role. She said that one of the big challenges in any group collaboration is the distribution of work. Those who are leaders will naturally take on more work while others may just laid back and become less involved.

Elizabeth said she identified herself as a part of the whole group. She described her feeling of "togetherness" and having mutual goals helped her get focused. "Our suite is a little society and out chat is kind of like the town meeting," said Elizabeth. She said that because the group "struggled together" in completing tasks throughout the semester, they build that sense of "togetherness" and "team cohesiveness." Elizabeth thought the term, "leader" should be called something else in the online collaborative learning environment because there could be multiple leaders in a group. She said some members are better at making decisions while others may be good at communicating with others; some are good at finding resources while others may be good at organizing various ideas; some are good at keeping members on track while others may bring the group joy and cheer everyone up when the group is stressed.

Environment

Participants referred "environment" as the course virtual workspace and the people involved. Agnes thought that the "patterns of relationships" have strong connection with the environment they find themselves in and that this CSCL environment was largely crafted by the instructor and technology. She said, "Life imitates art." Agnes believed that, "all thought internal is first modeled through the relationships occurring externally." She thought our "consciousness comes after relationships" and "dialogue comes before internal monologue." Agnes suggested that CSCL instructors, when designing their courses, should "create a safe environment" so that students would not "just project their meanings on everything" but would "take risks" and "experience the new meaning and new structures." Instructors should also consider their own "values" because instructors are "part of the big environment" and their values impact how students experience the process, she said.

Elizabeth perceived the course environment as a place where people "come together" to make friends and accomplish tasks. Due to the various tools used in the course, Elizabeth perceived environment as multiple places. She said she was often confused by too many places to go to interact with others and to work through assignments. Angel perceived the environment as a very structured place where students learn, interact with others, and accomplish tasks. Nancy viewed the environment as a "big open communication space" where people just come together and collaborate on a variety of projects. She said, "supervision is required." Students need to "have enough guidance" rather than just being "left alone" and there should be "some kind of facilitator or mediator to solve conflicts" and to "encourage people to be more honest with each other."

Angel said the course was very well-structured and there were many intensive tasks they had to accomplish. The course expected students to log-on everyday and arranged one "sherpa" in each team. However, "sherpas" have different styles, knowledge, status, and access to specifications about the course. When members of the group encounter problem, they look up to "sherpas" to answer their questions immediately and take the leadership role to guide their work. She said her group "sherpa was very encouraging and cheerful" but she said most class members expect to have more frequent and consistent feedback from sherpas and they need feedback on their progress from the instructor. The course designed many interactive activities for members to collaborate, but there seemed to be lack of interaction between students and sherpas and between students and the instructor.

Feelings

Participants expressed feelings of uncertainty, stress, frustration, and alienation. Agnes said she felt "alienated from others" and "unbelievably stressed" because of the "tight schedule" and the "nature of the work." Agnes said she likes to "be around people" but her frustration came from needing "to be with people" and "to do works that have meaning." Agnes expressed her hopes, fears, and worries: "I worry that we are bringing our old solutions to the new forms." She challenged Web-based instructors to deliberate on a question: "Will people realize their potential for humanitarian action or be seduced by the flavor of power and reduce further our chances to create a joyful world?"

All participants shared similar feelings of stress and uncertainty in this Web-based CSCL class. Agnes said that she did not know what others were thinking and feeling because feedback was either delayed or non-existent. "There are many things that you can't predict," said Nancy. She said she was not sure that "true feelings" were routinely expressed online. "People would be greeting each other or whatever, but you don't know if they meant it or just typed it," Nancy added.

Elizabeth and Angel expressed feelings of confusion and frustration. Elizabeth said, "You have to go to different places to get one piece of information sometimes." She suggested that the navigation should be as simple as possible for users rather than offering multiple—and confusing--paths for users. Angel recalled her difficulty accessing the computer. She said because it was her first semester in a foreign country, she did not have a computer. The University libraries often close on holidays so she could not do the work. Angel said she sometimes became frustrated when some TeachNet functions did not access from the Web or when the server would go down.

Personal variables

Agnes thought personal factors influence understanding, thinking, and experiences in any given setting because, "Everything is a system. A person is a system. When they enter a relationship or an environment, they bring in wherever they are at." Agnes described her group as a meeting place where "the full personality drama" occurred and where everyone diverged in their "working and writing styles." Agnes thought, "some people are more comfortable with patriarchal hierarchies" which, she said, is not based on ethnicity or gender. Like Agnes, Nancy also perceived that personal variables influenced online collaboration. She observed differences in personalities, preferences, interests, values, cultural backgrounds, communication styles, and working styles. Nancy said that she tried to "guess" what others' personalities were and attempted to "accommodate" their personalities based on "their contributions." She observed that everyone in her group differed in their priorities, in their reactions, and their modes of thinking, collaborating, communicating, and writing. Nancy thought her family upbringing also affects how she interacted with others. "I prefer people do what they are comfortable with," said Nancy. She thought that, "there should be one person taking the lead and others follow."

Elizabeth and Angel also expressed how their family upbringing affected their online behavior. Elizabeth said her family emphasizes responsibility and the importance of maintaining public decorum. She said living with extended family members is part of her culture, and from being exposed to various family members with multiple perspectives, she learned to accept and respect others' point of views more readily. Angel said in India, men and women are normally separated throughout primary and secondary education and the society is structured hierarchically. She said that because she often had to solve problems by herself while growing up, every time she encountered difficulties in the CSCL class she would attempt to solve problems by herself rather than seek help.

Conclusion and Future Implications

The findings of this study suggest that participants perceived communication and interpersonal relationships as two major areas of concern in the online group collaborative learning environment. Future studies should focus on the social aspects of interactions in the Web-based computer supported learning environment. Further, the implementation process should be closely examined in order to gain a better understanding of how various learners define knowledge, how knowledge is communicated and negotiated among learners of diverse backgrounds, and how knowledge is constructed as the result of communication and negotiation.

Due to the nature of collaboration and the necessity to negotiate toward shared meanings, online collaborators reported spending a considerable amount of time attempting to understand, check, confirm, coordinate, and negotiate with group members. Future studies should focus on strategies utilized by experienced on-line collaborative learners to facilitate and ensure effective and efficient communication. In this study, participants suggested that in order to make the group decision-making process easier and results more meaningful, individuals should clearly state their expectations, be cognizant of the various cultural and individual notions of time and responsibility, be sensitive to others' perspectives and needs, and communicate frequently with group members to resolve conflicts.

Based on my findings and observations, the following is a list of eight suggestions for Web-based instructors to consider as they design online collaborative learning courses:

1. **Assumptions and Interpretations:** Both students and the instructor should be cognizant of their preconceptions, expectations, and possible assumptions. Our focus of attention and our behavior are both heavily influenced by what we know and how we know it.
2. **Social Aspects of Learning:** The social aspects of learning should be emphasized as much as the cognitive/ intellectual aspects of learning. The course instructor should understand the importance of designing activities that facilitate social interactions as well as the importance of constantly providing to and requesting feedback from learners.
3. **Positive Attitude**: Members of the community should maintain positive attitudes and strive to be open and flexible while understanding that learning is an ever-evolving process.
4. **Modeling**: The instructor should guide, coach, and facilitate learning by providing instant feedback. If the instructor expects learners to check-in everyday, he/she should do the same. Instructor and staff policies should be consistently applied to all members of the community.
5. **Real and Humanized Instruction**: The main emphasis of learning tasks should be on humans, not tools. Tasks that require students to mechanically perform procedures may not offer meaningful learning to learners.
6. **Process and Product**: The process of knowledge acquisition and group interactions should be evaluated as stringently as the final product. Since the human mind evolves through a process of perceptions altered by experience, how learners undergo knowledge construction and group collaboration are as important as the resultant product.
7. **Performance Assessment**: Learners should be held accountable—but accountability should be consistent and justifiable. How process can be evaluated should be incorporated and considered in performance assessments.
8. **Safe Environment:** An environment of fear, envy, and anger is detrimental to learning. Conversely, an environment of joy, mutual respect, and sympathy is conducive to learning. Learning is promoted in an environment where students are ensured free expression, are enabled to make mistakes because mistakes are explicitly viewed as acceptable inevitabilities in knowledge construction, are inspired and encouraged by peers and instructor, and are intellectually challenged.

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Handshakes in Cyberspace: Bridging the Cultural Differences Through Effective Intercultural Communication and Collaboration

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Abstract

In the online learning environment, communication and collaboration occur from a distance. In the absence of non-verbal communication cues (such as facial expressions, gestures, and tone of voice), understanding, communication, and interaction rest largely on individual assumptions and interpretations. The magnitude of these communication challenges increases as cultural differences among communicators widen.

The purposes of this study are to (1) discuss the role of effective intercultural communication and collaboration in the Web-based collaborative learning community, (2) examine helpful strategies utilized by both instructors and learners in a Web-based curriculum model where diversity is treated as a fact and collaboration among learners of diverse backgrounds as the norm, and (3) discuss future implications for integrating technology into curriculum targeted to global learning populations.

Introduction

The Internet has provided the possibility to erase geographic and interpersonal boundaries among people of diverse backgrounds, has created opportunities for widespread electronic delivery of news, information, and curriculum, and has altered the way we communicate, share knowledge, deliver education, and conduct business. Globally, market expansion and course offerings are increasingly assisted by use of the Internet. In education, the Internet has been widely used in preparing learners for "future responsibilities" and "success in life" (Dewey, 1938, p. 17). Cross-nation collaborative projects on the Internet across disciplines have exponentially increased internationally in recent years.

Amidst the hype of cutting-edge technology, however, it is often overlooked that computers do not think, only humans do; computers do not have agency, humans do; technological difficulties do not limit intellectual advancement, humans do. Technology potentially provides an array of resources, but also presents constraints. Indeed, humans ultimately decide how to utilize new technologies, and these decisions are often based on both proven (or unproven) and discovered strategies. To integrate technology into instruction and learning, it is essential to focus on human needs, strategies, perceptions, and experiences communicating and collaborating in the cyber-learning environment — rather than solely on the functionality of technological tools.

As Web-based learning communities and online school partnership projects exponentially expand globally, effective intercultural communication and collaboration is, as never before, of vital significance. Web-based instruction provides opportunities for a diverse body of individuals to interact. In order to suit individual learner's needs while optimizing their strengths and talents, Confucius said, instruction should be tailored to meet individual learner's needs. While instructors are challenged to understand and be sensitive to the needs of learners in their design and implementation of Web-based courses, learners' success hinges not only on their willingness, attitude, and devotion to achieve shared goals in a sea of information, but also on how they handle the challenges of consolidating fellow learning community members' multiple views, perspectives, and approaches.

Based on my Web-based collaborative learning curriculum model experiences as a student, researcher, moderator, instructional designer, and teaching assistant, this paper intends to explore how effective communication and collaboration among members of diverse backgrounds may be encouraged in the design and implementation process and to explore what intercultural communication techniques may be or have been utilized by members in the Web-based learning community in bridging differences, achieving group goals, and optimizing individual learning.

Web-Based Instruction: Opportunities and Challenges

The development of computer network technology provides opportunities for dynamic human contact and collaboration. Teachers at all instructional levels are learning and integrating technology into curriculum and instruction. Internet access in public schools and instructional sites in America has increased from 35 percent in 1994 to 89 percent in 1998 and is expected to grow further. Student computer use has also increased from 27.3 percent in 1984 to 68.8 percent in 1997. These changes represent increases of 10.3 percent at the Pre-K level, 10.4 percent in grades 1-8, 12.3 percent in grades 9-12, 9.5 percent at the college level, and 3.4 percent at the graduate school level (U.S. Department of Commerce, 1998). Major reasons for this rapid growth include technology's capacity for reaching remote locations while providing immediate and engaging communication, its promise of collaborative opportunities, and the human need for connection and interaction.

The Internet is a global society involving users of diverse backgrounds, and this global society is comprised of various communities with cultures of their own. This Internet society is constantly evolving due to the evolution of tools and stakeholders involved. In this society where people communicate to collaborate the methods of communication and collaboration evolve with the evolution of technological tools and the dynamics of human interactions.

Web-based instruction has often been implemented to supplement, enhance, and transform existing curriculum. Some instructors use the Web to post syllabus online, to supplement face-to-face class teaching, to broaden the scope of their instruction, or to deliver courses in their entirety. Many distance-learning courses, however, have encountered high attrition rates (Abdul-Rahman, 1994; Galusha, 1997), unequal participation and individual commitment, role ambiguity in group contexts, absenteeism, inattention to social relationships, and students feeling overwhelmed (O'Hara-Devereaux&Johnasen, 1994). The viability of effective communication and collaboration in the absence of face-to-face interaction has been questioned (Handy, 1995). When students find course content irre levant, perceive the environment as impersonal, can not obtain immediate technical or instructional assistance or timely instructor feedback, and feel disconnected from fellow learners, they may feel isolated, unmotivated, or unchallenged. These shortcomings originate from a lack of understanding and sensitivity to the dynamics of human interaction and the nature of human learning.

In the following section, I will first explore topics related to community-building, cooperative and collaborative learning, culture and communication, and intercultural communication as they relate to the curriculum model examined and the purpose of this study. Then, I will examine a Web-based curriculum model based on my two years experience as student, researcher, moderator, instructional designer, and teaching assistant within this model. Finally, I will discuss implications for future global Web-based learning curriculum.

Community Building & Web-Based Learning

Despite Thoreau's fervent wish for solitude while at Walden Pond (Thoreau, 1996), the effects of isolation are so powerful that isolation is a potent punishment technique. Parents and teachers isolate misbehaving children. Hostages are held in isolation, as are miscreant prisoners. Most of us cannot tolerate enclosure without contact for very long; we crave company to belong to and share with, and love is as necessary as the air we breathe. Similarly, contact is often necessary to accomplish our goals; communication is essential to our pursuit of achievement as social beings.

In "My Pedagogic Creed" (1929), Dewey said, "The educational process has two sides, one psychological and one sociological." Dewey emphasized the social aspect of learning. Dewey thought some schools failed because they neglected "the school as a form of community life." Educators are aware of and have been utilizing the power of people working together to build a "community of learners." Increasingly, this notion has been re-emphasized with the advance in technology and global network. "The community is something that happens. It happens when people speak to one another and listen to one another in an effort to discern the truth and to discover themselves in the process. It happens only in an environment of freedom and openness. Community happens only in an atmosphere of honesty and tolerance. Community happens when people care about one another and when they are willing to take responsibility for themselves as well as for each other," said Robert Berdahl, the chancellor of the University of California at Berkeley (Berdahl, 1998). It can be inferred from Berdahl's commentary that communication and collaboration are essential for community building.

Communities are essential in human history. We have constantly sought to survive collectively, to belong, to care, and to support each other. Various forms of communication and culture are often established in the community to maintain cooperation and collaboration. Maurice Friedman (1983) distinguished two kinds of community: a community of affinity, which refers to a group of "like-minded" people who have come together for security, and a community of otherness, which refers to when members of the group are not alike, but when they share common concerns. Within a particular virtual community (a form of network organization through the use of technological tools), people share "common concerns." They are not necessarily "like-minded" and while the same beliefs and values may not be commonly shared, certain visions, concerns, or goals are shared (Friedman, 1983).

Many educators believe that learning is more effective when collaborating students encounter conflicts (Piaget, 1977; Doise & Mugny, 1984; Savery & Duffy, 1996). According to these educators, educational, social, and cultural background differences are not necessarily negative, but rather, through interactions among different people new thoughts and critical thinking and analysis are inspired and opportunities for individuals to gain insights are provided.

- The richness of multiple perspectives in the Web-based learning environment, if fully nurtured, can help spur the formation of rich and innovative perspectives. Conflicts are positive when collaborators communicate and negotiate to reach a shared understanding, discover new paths, and construct new thoughts and ideas together. Sharing, exchanging, and negotiating provide learners opportunities to deepen their understanding. During the process of communication and collaboration in knowledge acquisition, negotiation, decision-making, and knowledge construction, learners hopefully slough off their unconscious reliance on preconceptions, biases, unproven interpretations, and assumptions.

Cooperative and Collaborative Learning

According to the 1999 U.S. Department of Commerce report, "21st Century Skills for 21st Century Jobs," the proportion of skilled in the workforce increased from 20 percent in 1950 to 60 percent in 1997 while the proportion non-skilled laborers in the workforce decreased from 60 percent to 20 percent illustrating that the demand for skilled workers has dramatically increased over the past half century while the demand for unskilled laborers has dramatically decreased. In this new economy, Fortune 500 companies regard "teamwork," as the most critical job in the 21st century skill. Concomitantly, the ability to cooperate, collaborate and work well with others is considered more important than basic skills (such as reading and writing) that traditional schools have long defined as being most important (21st Century Skills, 1999, p. 1).

Studies consistently indicate that cooperative and collaborative learning are not only effective in generating positive outcomes in academic performance, but are also influential in affective and social aspects of learning (Johnson, Johnson, & Smith, 1998; Slavin, 1991, Harasim, 1990). "When the classroom is structured in a way that allows students to work cooperatively on learning tasks, students benefit academically as well as socially," Slavin (1987) said in extolling the benefits of cooperative and collaborative learning.

Cooperation creates possibilities. As Fosnot, (1996) said, "As ideas are shared within a community, new possibilities are suggested to the individual for consideration. These multiple perspectives may offer a new set of correspondences, and at times even contradictions, to individual constructions." (Fosnot, 1996, p. 27) Johnson and Johnson (1990) concluded that, "Achievement is higher in cooperative situations than in competitive or individualistic ones and cooperative efforts result in more frequent use of higher-level reasoning strategies, more frequent process gain, and higher performance on subsequent tests taken individually (group-to-individual transfer) than do competitive or individualistic efforts" (Johnson & Johnson, 1991).

"Groups pull and tug. They pull between tasks to accomplish and work to produce, but they also tug to maintain cohesiveness and an optimal level of morale." (Schmuck & Schmuck, 1997, p. 263) Working in a group can be irritating and frustrating. While differences in knowledge and skills may influence overall results, major challenges and problems to cooperation and collaboration come from differences in attitudes and in individuals' willingness to communicate, negotiate, change, commit, and take responsibility — rather than superficial differences in gender, ethnicity, race, class, religion, or culture.

Culture and Communication

Mirroring the American community, public school students represent an array of cultural backgrounds. Globalization has widened the need for intercultural communication and collaboration. Dodd & Montalvo (1987) identified intercultural effectiveness as a desirable skill essential in creating a productive and non-threatening communication climate marked by non-dogmatic openness and innovation. Researchers have noted the limitations of and misunderstandings in cross-cultural dialogue, the importance of cross-cultural learning, and the necessity of being culturally sensitive and responsive (McLoughlin, 1999).

With ample knowledge and strategies, technological tools are the means rather than ends to goals we want to achieve. Given the importance of global communication and collaboration, it is essential to assess what we can do to bridge the differences among members in the community and to establish culturally sensitive curriculum suitable for learners of diverse backgrounds.

Culture and communication are intertwined and interdependent. Culture influences the way we make meaning, interpret, and communicate messages. Culture is complex and involves a plethora of systems. As described by Carley H. Dodd, "Culture is like a kaleidoscope with similar shapes but different colors, or at other times, with different shapes but similar colors" (Dodd, 1991, p. 12). Culture is often described as the dynamic interplay between the experiences of people and the social structure at large (Giroux, 1997; Collier, 1998; Grossberg

1992; Grossberg, 1997; Marcus and Shannon, 1997). Culture is the societal situation strained through the mesh of individual perception. This dichotomy is almost paradoxical in that culture is, in some ways, unique to the individual yet shared by a community. One's identification with a culture comes from the "sameness" that is shared with others.

Cultural differences, as referred to in this paper, are not limited merely to differences in ethnicity or nationality. Cultural differences indicate "patterns of thinking, feeling, and acting." (Hofstede, 1997, p. 5) A group holding the same "shared constructions" (Erlandson, et.al.,1993, p. 24) represents a culture of its own. Those unfamiliar with the online learning "culture" may easily get lost in the cyber environment and feel isolated. Those ignorant of their own and other's culture may feel isolated within a collaboration environment. Those unwilling to be open to and respectful of multiple perspectives, accepting of ambiguities or uncertainties, flexible, and sensitive and mindful of cultural communication differences may encounter difficulties in the collaborative learning environment.

Collier (1998) characterized cultural identities as historical, contextual, and relational constructions that have "enduring" and "changing" properties. Cultural identities emerge in everyday discourse and in social practices, as well as by rituals, norms, and myths that are handed down to new members (Collier 1998). Because of mobility, greater accessibility of information, and expanded multi-group membership, the stereotypical generalizations has become increasingly invalid. Most people belong to multiple groups (both voluntary and not). Dodd suggests that the "macrocultural system" needs to be considered as well as the "subcultural differences" (Dodd 1991) when we look at individuals interacting in a cultural context. While the society in which an individual is situated largely influences one's "macrocultural" perspective, the individual nature of culture lies in the uniqueness of the "subcultures" to which one belongs.

In the online learning environment, knowledge acquisition and group collaboration differ from personal encounters. In this environment, learners map their way through the process as they communicate from remote sites. When nonverbal communication cues such as facial expressions, gestures, and tone of voice are largely absent, the frequency of communication and the reliance on interpretation increases. Effective communication and collaboration in the cyberspace requires patience and tolerance as members work to understand one another in accomplishing group and individual goals. Gudykunst (1994), in describing effective in-group communication, said, "When there is a lack of connection between the participants, community cannot develop. For community to develop, dialogue is necessary. Dialogue involves communication between individuals. In a dialogue, each participant's feeling of control and ownership is minimized; each participant confirms the other, even when conflict occurs" (p. 223). Interpersonal relationships are essential for effective communication among members of the group. D.W. Johnson & R.T. Johnson (1975) suggested a few interpersonal processes and patterns of interaction within the structure of a cooperative learning environment: mutual liking; effective communication; utilization of fellow students as resources, division of labor, and divergent and risk-taking thinking. They also added that high interactions, trust, mutual influence, acceptance and support, emotional involvement, and coordination of effort are also essential.

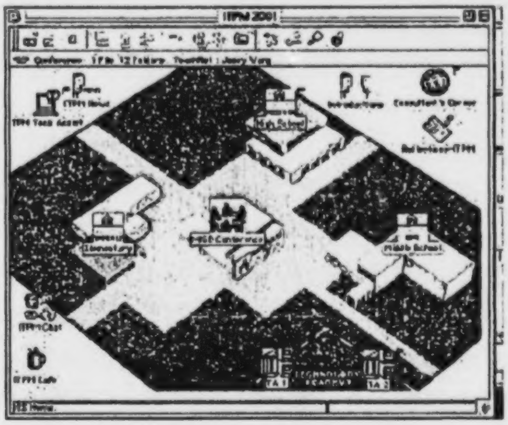
Collis (1999) proposed that cultural sensitivity should be a cornerstone in the design of Web-based courses because culture influences the acceptance, use, and impact of learning resources. Culture affects the individual's response to computer-related system (Collis 1999). Among Collis' suggestions, I find the following points important in designing a culturally sensitive course: (1) creating an atmosphere of non-critical acceptance of ideas; (2) moving from deficit-model thinking where the students begin with a deficiency in terms of a lack of pre-defined knowledge to a socially participative model where the students learn through communicative interaction with others that includes horizontal communication among students as well as vertical communication among the facilitators and students; (3) accepting tone and style differences in communication; (4) grouping of users to facilitate competence and comfort; (5) appropriately allocating responsibilities among students and facilitators; (6) accepting results of trial and error in course design; and (7) discarding the idea that learning or acting differently is unacceptable. Collis (1999) concludes that institutions and instructors will not only need to improve their insight into cultural differences that affect teaching and learning, but will also need to form these insights into manageable ways to respond to multiple cultures.

Bridging the Differences: A Web-Based Curriculum Model

This paper examined a Web-based Computer Supported Collaborative Learning (CSCL) curriculum model at the University of Texas at Austin. This model treats diversity as a fact and collaboration as fundamental for knowledge construction through the provision of rich information and resources to learners. In this model, multiple perspectives are valued. Students engaged in activities where knowledge is constructed through negotiation among collaborators from diverse backgrounds within the community. Group diversity is also carefully considered in forming collaborative virtual teams. Students were first asked to indicate their preferences based on their interests. Factors such as ethnicity, gender, computer skills, and geographic locations were then considered in building virtual teams.

This curriculum model, initiated by Dr. Paul E. Resta at the University of Texas at Austin, invited a group of graduate students from diverse backgrounds with various strengths and talents to participate in the course design, development, implementation, evaluation, and revision processes. Reflecting the diverse student body – and the collaborative nature of the course – these graduate students from diverse cultural backgrounds and expertise collaborate to design and improve the course throughout the curriculum development and implementation process. The course is based on an on-going revision process where researchers meet on a regular basis to share observations in order to improve the course.

Graph #1



Graph #2

Courses in this model are situated in the virtual environment where students "meet" through online communication and interaction. A virtual environment with collaborative tasks was created based on the metaphor of a hypothetical technology company, school district, or educational technology institute (See *Graph #1* for example of virtual workspace). Students are divided into groups representing a department within a company, a school within the district, or an educational sector within an institute. Problem- and project-based approaches to learning were employed. In these courses, students must collaboratively complete a technology plan, write a grant proposal, or design a CSCL course based on many structured tasks. To accomplish course requirements, online socialization and communication are essential, as are extensive cooperation and collaboration, among learners of diverse backgrounds.

Many online tools are provided to students to support the development of their projects. The course content with rich information and resource links is provided on the Web via a courseware (WebCT, Vcampus, or Prometheus), while class discussions and interactions take place at a virtual platform on TeachNet via FirstClass groupware. For synchronous interaction, the online chat function is employed. Learners participate in monthly Webcast (videoconference) on campus (face-to-face) or by way of network accessing (see *Graph #2* for example), which serve as a monthly forum for guest experts' discussion of relevant topics, teams to share their work, and the instructor to answer student questions or give advice. Courses are divided into modules; module tasks progress from simple to complex. Learners are either on-campus students at the University of Texas at Austin or distance-learning students from across Texas and the United States. On-campus students have the option of meeting the instructor, staff, and peers face-to-face or through the Internet, while off-campus students can interact only via the network and phone communication.

Communication: Challenges and Strategies Employed

Communication in the Web-based collaborative learning environment includes both task and social aspects. Due to communication limitations, online collaborators easily spend a large portion of time understanding, checking,

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confirming, coordinating, and negotiating to obtain mutual understandings and to construct shared knowledge. With the limitations in Web-based communication tools and the resultant reliance on interpretations and assumptions, effective communication among learners of diverse backgrounds is very challenging. A few examples of Web design that may be open to cultural interpretation include: various expectations for communication (some learners may expect daily communication from others in the team while others are not accustomed to communicating online), the amount and type of information desired and required (some learners may expect explicit information while others who are accustomed to implicit expression do not feel comfortable being direct), communication styles and preferences (some prefer to take turns, some like to jump to conclusions, while others like to wait for cues), level of task orientation (some are task-driven high achievers while others take a laid-back position), variation in understandings (some are from the culture where the course is situated while others may situate in a completely different culture), group orientations (some prefer and have experience working in groups while others prefer competition rather than collaboration), and group dynamics (some cultures may look to a leader for direction while others work better when there is no single leader in the group).

As opposed to face-to-face settings where communicators are recognized as human, in the Web environment, people are often objectified and largely recognized by name. As opposed to face-to-face settings that are conducted naturally, in the Web environment, there is usually a 45 seconds time lag between event and broadcast. As opposed to face-to-face settings where it is possible to drag a person aside and whisper in privacy, in online chat, this is not possible because everyone shares the same space. As opposed to face-to-face settings where communicators can choose their focus of attention (or inattention), in the video-conferencing environment, the camera setting dictates viewers' attention.

In my previous study entitled, "Multiplicity and flexibility as design features – A case study of a Web-based collaborative learning community for diverse learners" (to be published in the Computer Supported Collaborative Learning 2002 conference proceeding), I identify multiplicity and flexibility as two key course design features essential for meeting the needs of students from diverse backgrounds. As a teaching assistant, I worked closely with the instructor and learners and observed the course while assisting in its implementation. A few course aspects were highlighted to illustrate multiplicity and flexibility: course content and structure; communication tools, channels, and types; support, accessibility, and feedback; and performance assessment. Multiplicity refers to the multiple ways of presenting and delivering course material, channels of communication, activity offerings, and learning strategies. Flexibility refers to the welcoming of and openness to questions and suggestions, timely support, options for learning tasks, and provision of individualized feedback throughout the course.

The provision of multiple learning options is critical to enable deeper understandings among students from various cultural and social backgrounds who hold widely divergent individual values and interests. Multiple course representation methods were employed to meet the needs of multiple users. These representations included text, audio, video, and simulation, as well as multiple learning contexts and strategies. This curriculum model provided options in some assignments. For example, in one of the classes offered, students had the options of type of medium and their focus in an assignment regarding leadership visions. Some students chose film, others chose print, while others drew from their own experiences. A Korean student chose to write about her president while another Caucasian student chose a female leader because she said that female leaders have been largely unheralded. The provision of options gave students of diverse cultures, needs, and values the opportunity to situate their learning in the context of their culture or values in order to achieve deeper understandings. As no plan is perfect, adjustments to the course content and schedule were necessary throughout the implementation process. Reflecting the flexibility of this course to meet the needs of diverse learners, approaches, methods, and schedules were adjusted and alternatives provided when technological failures or technical setbacks occurred or to accommodate learners' unforeseen personal problems and difficulties.

In the required end-of-module learning reflections, learners in this curriculum model indicated a few effective strategies for online collaboration within this model. These strategies include: ensuring the technical aspects (such as necessary software downloads) are solved upon initial entry; employing frequent and cumulative check-ins to ensure optimal participation; ensuring adequate time for ice-breaking and team-building to facilitate team coherence and success; providing positive, constructive feedback and encouragement to peers; establishing multiple leadership roles; and setting meeting agendas for effective decision-making and collaboration. Students also indicated that equally essential strategies essential for online collaborative success were taking initiatives on tasks, honestly and sincerely communicating needs and intentions, and encouraging risk-taking by celebrating multiple perspectives. A few learners indicated that language is often the major challenge for students whose native language is not English because culturally related idioms and slang used. These non-native English-speaking students suggested that language deficiency is an invalid basis for judging other because an individual's talents are simply masked by language deficiencies. Indeed, many non-native English-speaking students reported gaining confidence in their communication abilities as the course progressed, illustrating the positive effect of collaboration in bringing out the multiple talents of diverse learners. Many students suggested that it is important to be sensitive to other's needs, encourage participation, and to provide positive feedback. Learners further suggested that regular contributions from all group members is essential to members' feelings of connection and sense of community, as well as to the completion of tasks.

Conclusion

In light of the global community spawned by the World-Wide-Web and the increased preponderance of global Web-based learning communities through cyber instruction, this paper discusses why culture and communication are important considerations when designing and implementing Web-based collaborative learning communities. Based on a Web-based CSCL curriculum model, this paper discusses some strategies employed by the instructor and instructional designers to enhance the design and implementation of the course to optimize individual and group learning among learners of diverse backgrounds; to facilitate class communication as well as by learners of the community to better collaborating with peers with various patterns of thinking, frames of mind, and school of thoughts.

Communication among people of congruent cultures, societies, and backgrounds – or even from the same family – is challenging. Communication among people of different cultures, societies, and backgrounds is even more challenging. Collaborative communication across cultures in the online learning environment requires the willingness of community members to listen, to respect, and to accept different perspectives; to accommodate and negotiate in order to reach shared meanings; to be flexible in their acceptance of ambiguities; to provide mutual respect, trust, and support; to develop cultural sensitivity and to understand the value of multiple perspectives; to negotiate shared meanings; to obtain mutual understanding, and to reach consensus for the achievement of the shared goals and needs.

Given the diversity of the global Internet society, cultural sensitivity and flexibility are essential to collaborative virtual classroom success. Future studies should focus on the needs of learners from diverse cultures in the design and implementation of virtual curriculum and in virtual classroom intercultural communication and collaboration. Web-based instructional designers, instructors, and moderators should employ multiple approaches and strategies in designing, developing, and implementing their courses and in assessing students – while always keeping in mind the needs of learners from diverse backgrounds – to inspire and encourage constructive work. Cultural sensitivity may assist in bridging the cultural diversities and contributing to overall course success. Building global communities of diverse learners requires that courses not simply represent an autocratic instructor's curriculum in the absence of consideration of multiple needs and resources; the ideal curriculumshould consider multiple perspectives, provide multiple communication and learning styles, and allow a high level of flexibility.

As the Chinese philosopher and educator Confucius said, "Education should be provided indiscriminately. Teaching should be tailored discriminately." This implies the duel notions of equal opportunity among learners under instruction tailored to the needs of individual students. For optimum learning to occur, instructors should be cognizant of cultural differences, but also should also cognizant of the challenges to intercultural communication and the need to be sensitive to the diverse needs of learners during the process of instruction. For optimum learning to occur, experienced experts' strategies of tailoring instructions to learners' needs and facilitation of group interaction need to be shared.

Web-based instructors of diverse student bodies face the same challenge as Chinese cooks – it's all in the mix. Just as Chinese cooks need to know the functions of various ingredients, instructors need to know the strengths and weaknesses of various learners. Just as Chinese cooks need to know the combined effect of various components, instructors need to know how to maximize the divergent abilities of learners. Just as Chinese cooks need to temper the use of spices, temperature, and cooking time, instructors need to temper the pace and demands of instructional strategies. Without these sensitivities, optimal performance cannot be attained.

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The Medium is the Message – The Design of an Online Collaborative Learning Community

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Abstract

This paper describes a constructivist and collaborative approach to transforming a traditional face-to-face on-campus course into an entirely Web-based course. The major objectives of this Computer-Supported Collaborative Learning (CSCL) course are for students to experience, learn and design online collaborative learning. This paper is based on the multiple experiences and perspectives of the course instructor, a course designer who also served as one of the moderators, and a student in the course The purposes of this paper are to (1) describe the design, implementation, and evaluation strategies used in this Web-based collaborative learning course, (2) examine the characteristics of the authentic environment designed to enable students to experience the strategies, opportunities, challenges and benefits of online collaborative learning, (3) discuss the roles and benefits of using "e-sherpas" as a unique support system for online learning teams, (4) explore students' perspectives, reflections, and suggestions, and (5) discuss course evaluation results, lessons learned, and implications for design of online collaborative learning environments.

Introduction

Just as companies are expanding their markets globally through the Internet, so are universities increasingly offering courses globally through the Internet. There has been rapid growth in the number of courses being offered either entirely online or as a supplement to a face-to-face course (Underwood et al., 2000; McLoughlin, 2000; Mugler & Landbeck, 2000; Graham & Scarborough, 1999). Online courses span a broad spectrum of pedagogical practices from highly controlled, linear, and teacher-centered online curriculum to situated and learner-centered curriculum. Most courses are driven by the functionality and availability of tools while others are inventing new tools or new approaches to meet the specifications of a particular curriculum structure and goals.

Many online courses simply transfer face-to-face classroom lecture-based content onto online platforms without considering interactive and human factors. Instructors who transfer lecture-based face-to-face instruction models to web-based environments, often tend to create online courses with little interactivity or opportunities for students to engage in discourse, collaboratively solve problems and construct their own knowledge. Although the value of collaborative learning is recognized, many instructors are unaware of the strategies and processes for building viable virtual learning teams. Instructors and instructional designers need to understand the nature of online interactions and communications, the dynamics of group collaboration, and strategies for facilitating online interactions among diverse learners in order to design effective web-based learning activities.

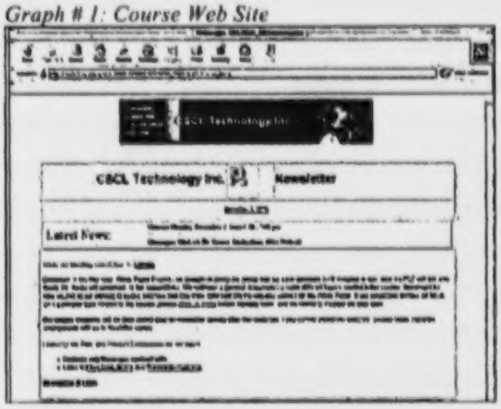
The paper examined the design and implementation of a Web-based collaborative learning course that was offered at the University of Texas at Austin in fall, 2000 from the perspectives of the course instructor, a member of the instructional design team who also participated in this course as an e-sherpa (e-moderator), and a student who completed the course. The paper describes the specific design features of the course and examines the effectiveness of the e-sherpa as a support system for virtual learning teams based on feedback from the students, instructor and the e-e-sherpas. It also discusses the lessons learned and the implications for design of online collaborative learning environments.

The Course Context

A major goal of this CSCL 2000 course was to help learners understand, create, and reflect upon online collaborative learning. A variety of instructional material, resource links, and scaffolding guidelines were made available to learning teams via the WebCT courseware (Graph #1). The course content was divided into seven modules, a course handbook, a course tool page, and a resource link page (Graph #2). Each module contained tasks in which learners had to work both individually and collaboratively to complete learning tasks. Collaborative tasks included writing a topic paper, designing a MOO (Multi-user Object Oriented) virtual environment where users log onto a site to experience a text -based virtual reality environment, designing a WebQuest, and working collaboratively with cross-team members to develop a final project utilizing a schedule planning tool for coordination.

Module One provided an overview of the course goals, objectives, required entry skills, technology requirements, course activity schedule, and other information helpful to the students in preparing to complete the course. Module Two provided opportunities for online socialization by introducing the mission of the course, the online environment and tools, and encouraging students to socialize with peers through a class-wide introduction activity. Module Three, Four, and Five required students to exchange information and construct knowledge through online communication, collaborative inquiry, dialogue and discussion, and team building. Modules helped students understand the unique aspects of online communication and collaboration and the need for respect, honesty and mutual support. Students worked collaboratively to navigate and explore various network environments, utilizing collaborative tools to plan, schedule, negotiate, develop, make decisions, and edit finished projects as a group. The course involved developing complex collaborative documents, WebQuests as well as other intellectual products designed to engage the students in a variety of online collaborative activities with a range of collaborative technologies. In addition to the content in each module, a course handbook was developed to provide information such as a virtual office tour, an organization chart about this virtual company, a staff directory which contained information about students in the course, tips on working collaboratively, topics for collaborative work, and project examples.

Graph # 1: Course Web Site



Graph # 2: Course Modules

Handbook
Course Tools
Resources

To accomplish course requirements, online socialization, collaboration, and communication were essential. Extensive cooperation and collaboration among learners was necessary. Web-based groupware tools offered students opportunities to exchange information, discuss tasks, upload files, work collaboratively on the same document, and socialize both asynchronously and synchronously (Graph #3). In order to provide an authentic environment, the metaphor of a high technology company, *CSCL Technology Corporation*, was employed to simulate a real world professional setting. Members of the class were divided into five virtual teams located in suites. There were two to three offices within each suite. Two to three students shared the same office and six to seven students shared the same suite (Graph #4). Diversity (ethnic background, gender, and on-campus or tele-campus access) was considered when assigning students into suites at the beginning of the semester.

Students in this CSCL course had to interact with peers, the instructor, and e-sherpas. The use of the e-sherpa is one of the key design features of this CSCL class. There was one e-sherpa in each suite of from 5-7 members. The term sherpa is used to describe a skilled Tibetan mountain climber on the southern slopes of Himalayas. The function of a sherpa on a mountain climbing expedition is to familiarize the expedition with the local terrain and to help members of the group carry their load. In this course, the e-sherpa was used to describe experienced online mentors who worked with online students in groups and helped them become self-directed and self-managed and to assist students with any challenges they encountered.

A monthly newsletter was provided at the course Web site. Students could obtain information about the regularly-scheduled Webcast (a video conference session where on-campus students can attend at the campus site and tele-campus students could attend through the Web). There were a total of five Webcast sessions in this

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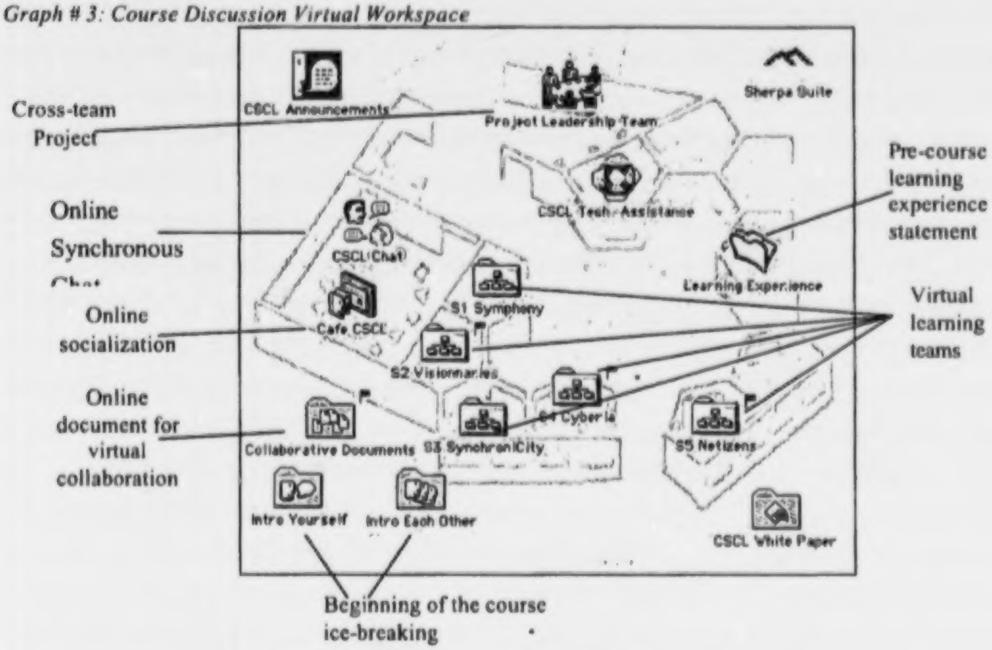
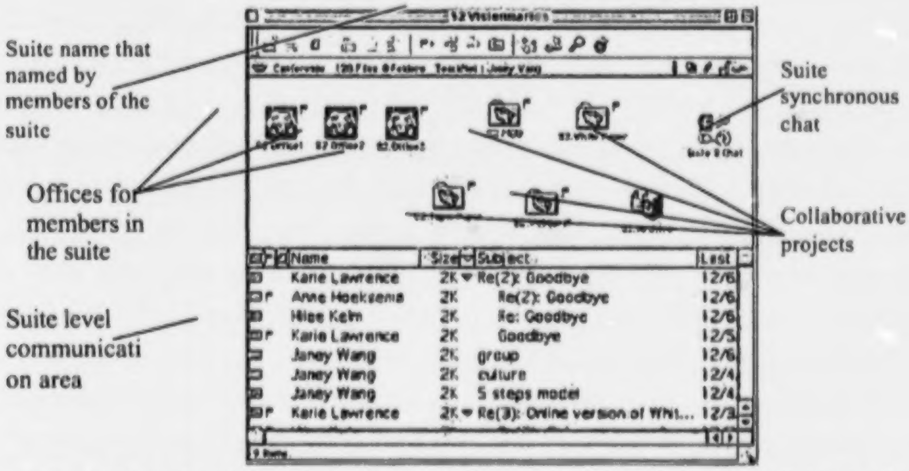
semester long course. During the Webcast, students could also participate through the dial-in phone conference from home or through the synchronous online class chat.

Graph # 3: Course Discussion Virtual Workspace


CSCL Announcements
Project Leadership Team
Sherpa Suite
CSCL Tech Assistance
Learning Experience
CSCL Chat
Cafe CSCL
S1 Symphony
S2 Visionnaries
S3 SynchroniCity
S4 Cyberia
S5 Netizens
Collaborative Documents
Intro Yourself
Intro Each Other
CSCL White Paper
Cross-team Project
Online Synchronous Chat
Online socialization
Online document for virtual collaboration
Pre-course learning experience statement
Virtual learning teams
Beginning of the course ice-breaking

Graph # 4: Online Virtual Team - Offices and Suites


S2 Visionnaries
Suite name that named by members of the suite
Offices for members in the suite
Suite synchronous chat
Collaborative projects
Suite level communication area

Name	Size	Subject	Last
Karie Lawrence	2K	Re(2): Goodbye	12/6
Anne Hoeksema	2K	Re(2): Goodbye	12/6
Hilee Kelm	2K	Re: Goodbye	12/6
Karie Lawrence	2K	Goodbye	12/5
Janey Wang	2K	group	12/6
Janey Wang	2K	culture	12/4
Janey Wang	2K	5 steps model	12/4
Karie Lawrence	2K	Re(3): Online version of Whit...	12/3

The intellectual products developed by the learning teams were based on the individual and collective contributions of members of the group. In accomplishing collaborative tasks such as creating the topic paper, navigating a MOO tour, producing a WebQuest, and writing a cross-team "White Paper." With the assistance of various tools, learners not only learned how to exploit the functionality of the tool in working collaboratively, solving problems, making decisions, and producing products. Throughout the course, learners reflected on their learning at the end of each module through personal journaling.

To assess and improve students' performance and ensure learners are held accountable to each other, evaluation rubrics were used throughout the course. Rubrics are a type of scoring guide, used to assess more authentic and complex performances and products. According to Mary Rose (1999), rubrics provide "authentic

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assessment" so the evaluations of student performance are "closer to the challenges of real life than isolated tests." Rubrics that "communicate detailed explanations ... benefit students in making them more conscious about their own learning outcomes and process," but also benefit instructors by providing them with an objective basis for assigning grades and involving students in the evaluation process.

The Medium is the Message

Two of the major challenges in Web-based courses are faculty understanding the pedagogies for engaging learners in the online learning process and the heavy demands on the instructor to monitor and manage the course. Many distance-learning courses experience high attrition rates that result from a complex of factors such as learners feeling isolated, unmotivated, overwhelmed, or unchallenged in distance learning courses. This results in the 32 percent dropout rate for online courses as compared to 4 percent for regular classroom classes (Viers, Robert).

In addition, it is easy for faculty to get overwhelmed by the amount of work it requires in developing Web-based courses. This work involves developing the initial idea of the online course and re-conceptualizing the instructional practice in order to integrate technology into curriculum. It involves extensive work in designing and developing the course content and activities, and further, to implementing and evaluating the course so students feel motivated, satisfied, and engaged. The entire evolutionary process is very costly in terms of faculty and staff time in developing the course.

Course Design: Constructivist Theory for Authentic Environment Design and e-sherpas

The philosophy behind the design of the CSCL course is Constructivism. Constructivism can be defined as a theory of learning in which knowledge is constructed in the mind of the learner. Jonassen (1994) identified the following elements of constructivist design: (1) multiple representations of reality, (2) representing the complexity of the real world, (3) emphasizing on knowledge construction instead of knowledge reproduction, (4) emphasizing authentic tasks in a meaningful context rather than abstract instruction out of context, (5) preferring real world settings to predetermined sequences of instruction, (6) encouraging thoughtful reflection on experience, (7) knowledge construction should be both content- and context-dependent, (8) knowledge construction should be through collaboration rather than competition among learners.

Reflecting Jonassen's points on constructivist theory, various design features were employed in this CSCL course. As an example, a rich learning environment with multiple forms of representations were provided to allow learners with multiple intelligences to feel comfortable in the environment and to exhibit a broader range of their talents and expertise. The provision of an authentic environment is one of the major messages this course was intended to deliver. Both cognitive and social aspects of learning were emphasized in the course. Students worked in teams throughout the semester to complete tasks. Multiple perspectives were encouraged. Authentic tasks and activities, reflecting real-world settings, built in a coherent framework allowed learners to solve problems collaboratively and develop critical thinking skills.

Constructivist classrooms are different from traditional class settings. In this environment, students work in groups while individual contributions are highly valued. Activities require students' contributions. Curricula data generated in the environment are based on dialogue and interactions among learners. The instructor, rather than a sage on the stage, seeks students' points of views and facilitates student learning. The understandings obtained from students are used as references for on-going course revisions. The learners, rather than passive knowledge absorbers, are viewed as thinkers and active learners. The assessment of student learning is usually based on students' work and progress throughout the process rather than paper-pencil tests predetermined by the instructor. The features of constructivist classrooms were deliberately built in the online CSCL curriculum.

Brooks and Brooks (1993) have identified characteristic teacher and student behaviors that are commonly found in constructivist classes: (1) encouraging student autonomy and initiative, (2) asking open-ended questions and allowing time for responses, (3) encouraging higher level thinking, (4) encouraging dialogues between the instructor and students and among students, (5) challenging students' existing knowledge and encouraging discussions, (6) encouraging the use of raw data, primary sources, and manipulative and interactive materials.

The authentic environment in this Web-based CSCL course engaged students in thoughtful and collaborative activities. There were a variety of ways team members could communicate creatively and flexibly with each other and with the instructor. As an example, students collaborated to produce projects and make decisions in pairs, in small groups, and across groups. The asynchronous nature of communication allowed learners to have opportunity for reflection and revise their answers rather than reacting immediately. The authentic activities presented learners with various problems and engaged them in various forms of collaboration and cognitive challenges. Further, multiple perspectives among diverse learners challenged learners' existing knowledge and encouraged them to actively participate in conversations in order to achieve group success.

The CSCL class involved learners in the cognitive process in three ways: (1) The course content involved learning how to use collaborative tools, (2) The course organization involved learning how to work collaboratively with others in complex learning tasks, (3) The course location involved learning how to work at a distance, synchronously as well as asynchronously.

For better course management and learner support, the concept of the "e-sherpa," coined by the instructor, Dr. Paul Resta, was employed to function similarly to the e-moderators described by Salmon (2000). Gilly Salmon used a few case studies to describe the e-moderators' role and responsibility. As an example, Quantas College Online (QCO), an online course established in 1996 for the purpose of training all staff within Quantas Airways, expected e-moderators to welcome and encourage participants, monitor learning progress, provide feedback, facilitate learning sessions, moderate discussions, provide input, assess learning outcomes, maintain records, and update status of participants.

In this Web-based CSCL course, an e-sherpa represents a non-authoritarian support person who climbs the mountain with students to help them accomplish their goals rather than directing and leading students. The role of the e-sherpa differs significantly from the traditional authoritative leadership figure. Much like real Tibetan sherpas, the e-sherpa in this course context is neither that of serving as the leader of the team nor as the authoritarian figure of the group. Their role was to simply accompany learners and to help the online team carry the load and accomplish its learning goals. In this course, e-sherpas were a group of graduate students who had prior knowledge of the similar course structure, experience in working in online teams, good communication skills, and who were interested in the online learning environment. Some of the e-sherpas were employed at the CSCL course instructor-directed computer lab while others participated on a volunteer basis online.

The e-sherpas' roles and responsibilities included unobtrusive approach to participating and supporting learners, assisting learners when they encounter technical difficulties, clarifying assignments when necessary, providing emotional support as needed, communicating and mediating conflict within the team, helping carry the load when emergencies arise, providing positive feedback and encouragement, monitoring learning progress and sharing with the instructor and fellow sherpas.

Students' Perspectives: Issues related to course design and implementation

The design and implementation of the course required extensive monitoring, feedback and on-the-fly revision of any uncovered problems such as broken link. Course revision was an on-going process and was based on the analysis on progress in course by the instructor and instructional designers as well as understanding learners' perspectives, experiences, reflections, and suggestions. The following sections provide a summary of the feedback from students in end-of-semester course evaluations which were based on a 5-point scale measurement and issues, perspectives, experiences, and reflections discussed from the perspective of one of the authors, who was a student in the course.

General Survey Results

- I am very satisfied with the course: **3.95**
- I have learned a lot in the course: **4.29**
- I enjoyed the course: **4.05**
- The course was very stimulating for me: **4.33**
- My cooperative/ collaborative skills have improved: **4.33**
- I would like to participate in other online courses: **4.71**
- By participating in CSCL activities, I developed new perspectives on learning: **4.38**

A Students' Reflections

1. Procedural issues

The flexibility of the FirstClass groupware to provide e-mail, collaborative documents, chat, and individual and group folders made it an ideal tool for use in collaborative learning. The FirstClass collaborative environment was, however, new to most students, and the business metaphor of suites and offices was also unfamiliar and at times confusing. As part of course requirements, students were expected to locate or deposit reflections, collaborative and individual project contributions, completed projects, introductory exercises, and work in progress documents in specific places within the virtual office. When students needed clarification to negotiate the complexities of the site, the sherpa was contacted and proved useful in clarifying these locations for the teams, especially at the beginning of the course.

In addition, the office metaphor was extended with the addition of a CSCL Announcements bulletin board icon, an icon for Tech Assistance, and a CSCL Cafe icon for informal comments unrelated to specific course concerns. The service provided by the Announcements feature was evident to all students, but the purposes of the Cafe and Tech Assistance services were sometimes misunderstood. On occasion the professor or the e-sherpa was sent questions that should have been directed to technical support, and the questions had to be forwarded to the proper technical support person. In the case of the Cafe, discussions posted there were sometimes course-specific and the class was reminded to exchange these comments in another location within their suite or office.

2. Third-party issues

The CSCL course employed several collaborative tools. As already mentioned, First Class trouble-shooting questions were sometimes misdirected to other persons instead of to the technical support folder. In the case of the other collaborative tools, in particular the various MOOs, Zebu, and the WebQuest building site, there was no clear source of technical support and students often spent more time trying to negotiate the pitfalls of the sites than they did working on some of the assignments. Some students experienced frustration and the pressure of meeting deadlines as they struggled with these sites. Of necessity, students established informal networks of assistance in which solutions to common problems were shared. A FAQ icon within the office graphic or one or more e-sherpas with special expertise would have been of great assistance here as expert resources to consult about the sites and their potential problems so students could more quickly use the resources.

3. Assignment clarification

Consistent with a constructivist philosophy the assignments were open-ended, varied, and not cumulative, and so each one had specific and unique features that the team members had to establish and clarify among themselves before and during their collaborative work. Students had to determine not only the specific content the assignment was requesting, but also the format it was to take, how it was to be organized, which parts were to be generated collectively, and which were to be generated individually and then collaboratively refined. They employed informal on-going formative evaluations as their work evolved and became more complex. There were project rubrics, which were ambiguous at times as assignment requirements were modified, as well as peer evaluation rubrics against which assessed students' contributions to the project. E-sherpas or the instructor were asked questions regarding the assignment components, and they responded with further explanations for teams or individuals.

4. Interpersonal issues

Students were placed in learning teams to assure diversity and balance in culture, knowledge of the content, and technology expertise. Occasionally, conflicts among team members arose related to differing expectations with regard to work or to interpersonal interactions. In order to successfully complete assignments, it was important for group members to take responsibility for participation in group work sessions and to meet deadlines. Sometimes work issues related to differences in quality or quantity of work arose in teams . Individuals and the group as a whole were challenged to negotiate mutually satisfactory conventions that enabled cooperation, compromise, and the giving and receiving of constructive criticism. These skills were vital for the development of quality team products and projects as well as timely completion of the project. The course design provided for the rotation of leadership roles among team members.. This allowed each team to find its own way of working best while giving each individual an opportunity for carrying greater responsibility for a while.

It was additionally important for group morale for members to be understanding, supportive, and encouraging of the work of other team members. In a few instances, individuals were unable or unwilling to serve as emotional as well as intellectual partners with their team members. In those instances, the team had greater difficulty in accomplishing its learning tasks. For the team to be successful, it had to find ways to resolve all of these issues and reach consensus. Over the entire period of the course, a general ecology of support emerged with each member contributing from his/her strength as roles emerged for leading in a variety of ways. The e-sherpas were consulted less and less and usually asked for help only when there was an impasse. At this stage, the problems were then addressed and resolved by the instructor.

Suggestions

E-sherpas have the potential to serve several useful functions in developing and supporting online learning communities. The responsibilities, however, may require special knowledge or training in order for them to meet all of the challenges in helping virtual learning teams be successful.

1. Course assignments should be made as clear as possible, taking into consideration that in real world settings a considerable amount of ambiguity is inevitable. The e-sherpa must have a clear understanding of the course assignment components in order to clarify them to the team while avoiding offering editorial comments on the work products themselves. Obviously this responsibility requires that the e-sherpas be kept up to date on any changes to the course and its assignments that are made as the course progresses.
2. A source of practical information about the courses' collaborative tools would be an important element in the technical support network and would fill a need not met by the courseware technical support staff. Team members could avoid frustration and lost time if they could consult a FAQ or e-sherpa with the ability to facilitate their use of the collaborative tools.
3. For many students new to online collaborative learning, some direct instruction or required reading about forming collaborative teams might ease their transition from the tradition of individuals working competitively to teams working collaboratively in a constructivist classroom. An e-sherpa with skills in mediating collaborative working interactions would be useful early in the course to assist the learning team in working through the awkward period of establishing individual identities within the group ecology. Such assistance might forestall the need for more critical guidance later by establishing a well-functioning team from the start. If difficuities arose later, a working relationship with a trusted and skilled e-sherpa might make resolution of the problems easier.
4. Much of what the teams devoted themselves to might more correctly be thought of as collaborative work rather than collaborative learning although all boundaries between the two are often unclear. Through guiding conversations throughout the course, an instructor or e-sherpa could provide a way for team members to become aware of how the course is structured to facilitate collaborative learning, consider what other collaborative strategies they might try, and examine the features of effective communication within a collaborative endeavour. Difficult decisions would need to be made to prioritise existing course goals, content, and activities to build in the time and opportunity for these interactions with team members to take place.
5. Feedback in the course for team projects as well as for individual contributions and reflections was relatively sparse. One feature of constructivist theory is time for reflection on the learning process. While academic feedback is the provenance of the instructor, if the e-sherpas were deeply engaged in observing the interactions within a team, he/she would be uniquely situated to give astute feedback to the team on the nature of its collaborative interactions and to draw members into conversation about what they were learning. Using the e-sherpa merely to convey observations on the workings of the learning teams and their academic products is useful but does not capitalize on the full potential of the e-sherpa in supporting the learning of the members of the learning community.
6. At its best collaborative learning can produce a learning experience and artifacts of that experience that are greater than what an individual student could achieve working alone. The time and opportunity for risk-taking are essential for reaching this higher level of achievement. In this particular course risk-taking on the part of individuals or teams was thwarted in a number of ways. The time allowed for assignment completion did not provide a cushion for false starts or revamping common in risk-taking situations. Fewer assignments or more relaxed time requirements might alleviate this problem. Instructor feedback and its associated reassurance and encouragement are also an intangible support for risk-taking attitudes among students. The course needs a faculty presence through feedback communication with teams and with individuals more frequently and more specifically to encourage students to test their potential. Finally, the frequent peer assessment feature of the course discouraged vigorous debate or discussion that might have resulted in the group undertaking a project that contained more risk.

> Team members were cautious in order not to be misunderstood and evaluated as uncooperative or unsupportive of the group.

To assure individual accountability, team members assessed their own contributions as well as those of all other team members at the end of each learning module. The positive aspect of the peer evaluations was that it helped individual team members who were late in contributing their work or participating minimally in collaborative task to become more active members of the learning team. It is also possible that the frequent peer assessments discouraged vigorous debate or discussion that might have resulted in the group undertaking a project that contained more risk. There was evidence that some team members were cautious in order not to be misunderstood and evaluated as uncooperative or unsupportive of the group.

Lesson Learned and Future Implications

Many instructors believe that online learning can have a very bright future if courses are designed well. Yet, merely transferring existing curriculum online and grouping students without regard to interpersonal dynamics will not achieve ideal student participation and collaboration. Instructors and instructional designers need to truly understand the nature of online interactions and communications, the dynamics of group collaboration, and strategies for facilitating online interactions among diverse learners in order to design activities for effective interactions.

Students and e-sherpas made various design and implementation suggestions at the end of the semester. Some of these suggestions included:

- Building trust by providing ice-breaking sessions at the beginning of the semester
- Providing e-sherpas' training prior to the semester
- Clarifying e-sherpas' roles and responsibilities prior to the semester
- Standardizing e-sherpas' monitoring process of learning teams' progress
- Standardizing e-sherpas' observation and report guidelines
- Specifying assignments and providing immediate clarifications of students' questions
- Linking design goals and implementation processes seamlessly
- Valuing the social aspects of learning equally to cognitive aspects
- Clarifying leadership roles by providing explicit guidelines
- Considering the number of tools employed carefully to avoid overwhelming students
- Avoiding holiday assignment deadlines by examining the course schedule
- Employing tasks as building blocks toward students' final projects
- Improving the immediacy of feedback for technical and instruction-related questions
- Providing frequent and constructive instructor feedback on students' learning progress
- Assisting students by conducting virtual office hours regularly
- Providing self-check quizzes in assisting learners in tracking their learning progress
- Surveying and identifying students' concerns and suggestions regularly
- Adjusting/revising course based upon identifying student concerns and suggestions

As one of the pioneers in online collaborative learning course design, we still have much to learn about the design, implementation, and evaluation to achieve optimal results in Web-based learning. The dropout rate of this CSCL course, however, was only two out of 32 students in class and the overall course evaluations were very high.. We understand that technology tools can only provide high quality in the hands of good teachers. Through the sharing of our experiences, good practices, perspectives, reflections, and suggestions, we hope to enhance online instruction in higher education.

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Simple Techniques for Using the Internet as a Supplemental Course Resource

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Abstract

With the wide acceptance of the Internet as an information and communications source, students have come to expect it to supply supplemental course material and other enhancements to their traditional classroom activities. Students have grown accustomed to the 'anytime / anywhere' capability and flexibility offered by the World Wide Web. This media will become a vital exchange mechanism between educators and students. However, the technologies that support the Web are very different from those traditionally used in the preparation and delivery of course content. This can make entry into the Internet course support arena a challenge for educators not familiar with its inner workings.

The same Internet acceptance and usage expectation that is forcing educators into the World Wide Web has also provided us with some simple tools and techniques that can be employed to begin the integration of the Web into course support. The Web has become so integrated into all aspects of computer usage that most personal productivity applications provide Web tools as part of the software. The degree of this integration varies with the application and the vendor, but these rudimentary Internet tools exist in much of the software educators use in course preparation and delivery. Through the application of these simple tools to the documents, spreadsheets, communications, and presentation currently generated, they can easily be made available to students through a Web page. Lecture notes, presentation slides, study guides, practice quizzes, solutions, and homework guides are just a few of the documents educators generate with a word processor. These can easily be converted to a format that is viewable over the Web. Grade postings and other data generated with a spreadsheet can be made available via the Web in a similar manner.

The on-demand availability of the Internet offers several advantages. Students can access information when they are ready to study, not when the instructor is available to present it. Students can access the specific information needed to finish a specific assignment. As a result of this information availability, the instructor will spend less time redistributing lost or missed information, and less time answering the same question from several different students.

On-demand information availability is beneficial to both traditional and non-traditional learners. Traditional students maintain the structure and control of traditional instructional methodologies while having increased access to support information. Non-traditional students are provided a mechanism that places them personally in control of what they learn, and when they learn it. This control is a necessary component of successful learning in the non-traditional student population.

The Internet offers the student more timely access to specific course-related information with less effort on the part of the instructor. Add in the wide acceptance and availability of the Web, and new opportunities for course and learning improvement become evident. With minimal effort, the Internet can enhance almost any course.

Introduction

The Internet is a widely accessible, on-demand source of information. Students have come to rely on the Internet for most of their information gathering activities. They go to the Internet for information on anything from the configuration of a networking cable to the show times at the local movie theater. Three fourths of all college seniors use the Internet in their job search. (Shelly 2000) Given this wide acceptance, it is reasonable to assume that students will also look to the Internet for course related materials such as lecture notes, assignments, grade postings, and even general communications.

Many institutions have a Web presence that is maintained by the institution. Frequently, the homepage of the institution's website will have links to individual department pages. These departmental pages will in turn have links to individual course pages. The institution will often provide a page for each course based on a common temple that is used for all courses institution-wide. This common template often includes standard links to common course page content such as grades and class notes. The faculty associated with a specific course are usually given access privileges to the folders that contain the Web pages for that course, thus allowing them to create and maintain course related Web content.

The Web presence for the course is in place. However, course information is available on the World Wide Web only if the course instructor makes it available. The tools and technologies that have traditionally been used to create World Wide Web content are different from those used to create normal course materials. Learning these new tools requires an investment of time that many faculty cannot justify. For this reason, many faculty do not support their courses on the Web even though a Web presence is already available.

The same wide acceptance of the Web as the de facto information source has encouraged many software developers to include Web support features in applications that have not traditionally been associated with Web content development. Currently, many of the applications that have traditionally been used in course material development include basic Web content development features. Personal productivity tools like word processors, spreadsheets, and presentation software now provide simple tools to generate Web content. With a basic understanding of the organization of a Web page, browser operation, and the tools available in current personal productivity software, most faculty can develop Web content to support their courses.

Web Page Organization

The World Wide Web is actually a wide area network of over 4 million loosely connected servers that provide information upon request. (Goldman 1997) These servers hold the files that create Web pages. When the server receives a request to view a Web page, the server downloads the files needed to create the page to the requesting computer.

Each Web server is identified by a unique name called a URL, short for Uniform Resource Locator. A URL consists of protocol specification, a domain name, and optional path to a specific Web page. URLs are specified using the familiar format **http://www.domain.com/path/page.htm**[2] In this example the protocol is **http**, which stands for hypertext transfer protocol. Hypertext transfer protocol is the communications standard (protocol) for transfering Web pages. The domain is represented by **www.domain.com**, and **/path/page.htm** illustrates the format for the optional page reference. In an actual Web page reference, the domain (**www.domain.com**) and the optional page specification **(/path/page.htm)** would be replaced with the domain name of the Website being accessed and the (optional) path and file name of the desired page.

Each domain must be registered with an organization that is responsible for assigning maintaining domain information. Each domain is associated with a specific location on the World Wide Web called its Web address. These addresses are composed of four three-digit numbers separated by periods (i.e. 230.195.013.212). (Goldman 2001) Domain information is kept in databases at specific locations accessible to the World Wide Web. When a user requests to view a website, browser software on the user's computer references the databases to determine the Web address of the website in question. A request is sent to the Web server at the address obtained from the domain database. The Web server at that address equates the domain to a specific folder located on the server. It locates a file in the designated folder titled INDEX.HTM and sends that file to the requesting computer. This file represents the homepage for that website. The Web homepage may be titled HOME.HTM on some system.[2]

Additional pages in the website are usually arranged in folders that are subordinate to the folder that contains the homepage. The folder system is used to organize additional pages that are referenced through the home page in the same way that folders are used to organize files on a drive. System administrators frequently use this type of folder arrangement to allow certain users access to certain areas of the website, without giving all users access to all pages of the website. Ideally, the instructors are given access to folders that contain information relevant to the courses they teach. This access allows the appropriate faculty to post course materials to the website.

The Web presence may be maintained internally, or it may be outsourced. If maintained in-house, the Web files frequently reside on a server within the institution. If the folders that contain the website files are accessible through the institution's network, it is possible to add content to the website directly, provided the user has been granted access privileges to the necessary folders. If access privileges are not available to the course instructors or if the website is maintained off-site, the institution will designate a specific individual, sometimes call the Webmaster, to post all files to Web folders. This is done to ensure that all postings adhere to institutional policies for Web content, and to maintain security. If the institution allows only the Webmaster to access the system, then all postings to the Web must be forwarded to the Web Master. The institution should have a mechanism in place to handle posting requests.

The URL will allow a browser to find a specific server on the Web. By including the file and path in the URL any file within that Web server can be accessed, even if there are no links from existing Web pages to that file. Faculty can place information on the Web, by either directly accessing the Web folders or by requesting postings from a Webmaster. Once the file is posted in the website, students can be given the complete URL to the file.

Students can access the file by entering the URL, complete with the path and file, into the browser. Links from other Web pages are not needed.

For example, let us place the syllabus for a course numbered CPT250 on the Web. The original syllabus is saved under the name **Syl250Fall01.htm** in the **My Documents** folder on the local C:/ drive. The Web site domain is **pua.edu**. The files used to generate this website are located on a network drive designated **W:/**. The CPT250 Web page is located in the **/courses/cpt/cpt250/** folder. Since a folder already exists for CPT250, we will place the syllabus in it. You Webmaster should be able to provide information on the folder layout for your Web site. Begin by moving the syllabus in the Web folder. Use Windows Explorer to copy the file **Syl250Fall01.htm** from the **My Documents** folder on the **C:/** drive to the **/courses/cpt/cpt250/** folder on the **W:\** drive. The last step is to provide students with the complete URL of the page, **http://www.pua.edu/courses/cpt/cpt250/Syl250Fall01.htm** Students can access the syllabus by entering this URL into a browser.

Many institutions provide a common template for course Web pages. The common template promotes a consistent look and feel to the Website, and also helps keep individual course pages consistent with Web policies. The Webmaster creates a Web page for each course from the template. Links are provided to the individual course pages from the home page. The template often contains links to such common components as grades, syllabi, and class notes. Exploiting these available links will ease student access to the information.

The key to using a predefined link from an existing page is knowing what the link accesses. Links are actually instructions to the browser to retrieve and display another Web page. Recall that Web pages are contained in files. Thus, a link contains the name of the file to be accessed. When a file of that name is placed in the appropriate folder, the link will retrieve and display the information from that file. Predefined links can be used only if the file name and path of the file the link accesses are known. The Webmaster should be able to provide this information or post files to the proper locations for you if access is restricted.

The file name is defined in the link when the Web page is created and is not easily changed. However, it is easy to change the name of a file. Changing the name of a file to match that specified in the link will cause the browser to display the information in that file. As an example, let us assume that a faculty member has a syllabus for CPT250 that needs to be posted to the CPT250 Web page. The original syllabus is saved under the name **Syl250Fall01.htm** in the **My Documents** folder on the local C:/ drive. The institution's Web site has a page for CPT250 with a *Syllabus* link that displays a file called **Syllabus.htm**. The website domain is **pua.edu**. The files needed to generate the website are located on a network drive designated **W:/**. The CPT250 Web page is located in the **/courses/cpt/cpt250/** folder. Again, we will place the document there. First, rename the **Syl250Fall01.htm** file to **Syllabus.htm,** the name of the file the *Syllabus* link will access. Next, copy the file into **W:/courses/cpt/cpt250,** the folder the link accesses. Use Windows Explorer to complete the rename and copy operations. If a file named Syllabus.htm already exists in the **/courses/cpt/cpt250** folder you will be prompted to replace it. Once the file has been successfully copied into the **/courses/cpt/cpt250** folder, clicking the *Syllabus* link will retrieve and display the syllabus.

The Browser

The browser is the application that allows a user to view information downloaded from Web servers. (Walters 2001) The user enters the URL of the website to be viewed. The browser locates the Web address from the domain database and sends a request to the appropriate Web server. The Web server downloads the requested files to the browser and the browser generates and displays the web page. The user must enter the exact URL in order for the browser to find the desired Web server.

Browsers use the data contained in the downloaded files to generate the Web page. This data must be presented to the browser in a format the browser understands. If the browser cannot understand the data presented, it cannot generate a Web page from it. The most common file format for generating text in a Web page is the HTML format. Hyper Text Markup Language is a formalized set of rules for specifying how text will be displayed. HTML adds additional information (called tags) to the text that instructs the browser on how the text should be displayed. As the text is downloaded, the tags are interpreted and the text is displayed accordingly.

Browsers can also display images in a Web page. Again, the data used to generate the image must be presented to the browser in a format that it understands. Most browsers understand many graphical formats. Some of the more frequently encountered graphical file formats are GIF, JPG, and PNC. Browsers can also generate audio from files using the WAV or MIDI format, and full motion video from A VI, MOV, and MPG formatted files. (Cadenhead 1999)

The browser can also provide limited access to files that are not in a format that it can understand. When the browser is asked to access a file in a type it does not recognized, it will offer the user the option if opening the file or saving it to a local drive. If the user opts to open the file, the browser will hand the task over to the local operating system. The operating system will check the file extension to determine if it is a file associated with a specific application on the computer. If a corresponding application is found, then the operating system will start that application and open the file in it. If the operating system does not find an application that it associates with the file extension, it will open a dialog box and ask the user to select the application to use to access the file. If the save option is selected instead of the open option, the operating system starts a download wizard that allows the user to select a location and name on a local drive where the file will be saved.

Generating Web Content: Common Personal Productivity Tools

The wide acceptance and use of the World Wide Web has affected much of the personal productivity software currently available. Many of the tools faculty currently use to generate course materials now have provisions for saving data in formats that browsers can understand. Word processors, spreadsheets, database, and presentation software now allow users to save documents in HTML format. Existing documents can be re-saved in HTML format, allowing creation of Web materials without additional work in a separate software tool. Once in HTML format, these files can be made available to students by placing them on the website. Students can, in turn, access the files through links in existing Web pages, or by entering the path and file name in the URL. All this is possible with a minimum of additional effort, using software the user is already familiar with. The keys to success are: 1) saving the documents in a format browsers understand and 2) placing these documents in the website where a browser can find them.

Saving in HTML: A Microsoft Word Example

Microsoft's word processor, Word, will save documents in HTML format. The following example uses the technique described above to save an existing homework assignment document in HTML format and place it on the Web for student access. The document is currently saved in a file called **Homework10.doc** and is located in the **My Documents** folder on the local computer. The new HTML version of the assignment will be saved in the webpage **pua.edu** in the **/courses/cpt/cpt250** folder. The Website home folder is designated as the **W:/** network drive on the local computer.

Begin by retrieving the original document into Word. Once the document is retrieved, save it in HTML format by clicking the *File* menu, and then clicking the *Save as Web Page...* option in the dropdown list. A new *Save As* window appears. Note the *Save In:* dropdown list in the upper left corner of the *Save As* window. Clicking the down arrow to the right of the input box will produce a list of all available drives. Navigate through this list and double click the **W:/** drive. A folder list will appear below the **W:/** drive icon. Next double click the **/courses** folder. Double click the **/cpt** folder in the list that appears. Double click the **/cpt250** folder in the folder list that appears below the **/cpt** folder. This will select the **/courses/cpt/cpt250** folder to receive the HTML file. Enter the name of the new HTML version of the document by typing the new name, **HomeWork10**, in the *File Name:* input box in the lower center of the *Save As* window. Do not add the **.htm** extension. The system will automatically append the appropriate extension when it saves the document. Finally click the *Save* button in the lower right corner of the *Save As* window. The HTML version of the homework assignment is now saved. Since the file was saved in a folder that is part of the Website, students are able to access the homework assignment on the Web by typing **http://pua.edu/courses/cpt/cpt250/HomeWork10.htm** in their browser's URL input box, or by clicking on a link to the file if one exists.

If direct access to the Web folders is not possible, the Webmaster will post the file to the website. First, save the Word document in HTML format per the example above but specify a local drive instead of the Web folder. Next send a request to the Webmaster to post the file to the Web. If the file will be accessed through the URL, the Webmaster should provide the complete URL after the posting is complete. If the file is to be accessed via an existing link, the Webmaster can place and name the file so the link operates properly.

Saving in HTML: A Microsoft Excel Example

Microsoft Excel, a popular spreadsheet application, will also save in HTML format. It is a common practice to post grades in a public place so students can monitor their status. This example illustrates how the Web can be used to post grades for student review by saving an existing grade spreadsheet in HTML format and placing it on the Web where students can access it. The grade spreadsheet is currently saved in a file named **GSP250F01.xls**. It is located in the **My Documents** folder on the local computer. The new HTML version of the grade posting will be saved with the name **grades.htm**, in the **/courses/cpt/cpt250/** folder of the website **pua.edu**, designated as the **W:/** network drive on the local computer.

The first task is to retrieve the spreadsheet and save it in HTML format. Start Excel and open the **GSP250F01.xls** spreadsheet. Next, save the spreadsheet in HTML format by selecting the *File* option from the menu bar, and clicking the *Save as Web Page...* option in the dropdown list. The *Save As* window appears. Locate the *Save In:* input box and use the down arrow to the right to display the list of available drives and folders. Navigate through this list until the **W:/courses/cpt/cpt250** folder is located and double click that folder. Below the *Save In:* input box is a *Save:* section. This consists of two option buttons labeled *Entire Workbook* and *Selection Sheet*. Click the *Entire Workbook* option. In the *File Name:* input box enter the file name **grades**. Do not include the **.htm** file extension. Excel will append the extension onto the file name when the file is saved. Verify that the *Save as Type:* input box contains **Web Page**. If not, open the list by clicking the down arrow to the right of the input box and select the **Web Page** option. Finally, click the *Save* button. The grade posting spreadsheet will be saved as **W:/courses/cpt/cpt250/grades.htm** Students can access the grades on the Web by entering **http://www.pua.edu/courses/cpt/cpt250/grades.htm** (the complete URL) into the browser. Clicking a link, if one exists, can also access the grades.

If direct access to the Web folders is not possible, the Webmaster will post the file to the website. First, save the Excel spreadsheet in HTML format per the example above but specify a local drive instead of the Web folder. Next send a request to the Webmaster to post the file to the Web. If the file will be accessed through the URL, the Webmaster should provide the complete URL after the posting is complete. If the file is to be accessed via an existing link, the Webmaster can place and name the file so the link operates properly.

Generating Web Content: Downloads

The Web can also be used to make non-viewable files available. The browser cannot display the content of these types of files because they are saved in a format that the browser cannot understand. If the browser does not understand the format of a file, it will offer the user the option of opening the file using another application or downloading and saving the file to a local drive.

If the *Open* option is selected, the local system will check for an application that understands the format of the file. If the system finds an application that understands the format, the file can be opened and manipulated just as any other local file, with one exception. The local application cannot save the file back to the Web site. It must be saved on a local drive. If the system cannot find an application that understands the file format, it will present a list of all application available on the system and allow the user to select the application to use.

If the *Save* option is selected, the user is prompted to enter the location the file will be saved to. The user selects the desired location and initiates the download. The file is copied from the website to the local machine.

Downloading and Opening a Word Document: A Microsoft Word Example

This example illustrates opening a Microsoft Word document file from a website. The file is in Word's **.doc** format, which is not understood by the browser. We assume that the student has Microsoft Word available on the local computer. The Web file is a Word document named **Homework10.doc**. It is saved on the Web site **pua.edu** in the folder **/courses/cpt/cpt250/**. To access the file click on an existing link or enter the complete URL and path into the browser: **http://www.pua.edu/courses/cpt/cpt250/homework10.doc**. A Windows Wizard will open offering option buttons for *Open this file from its current location* or *Save this file to disk*. Select the *Open* option button. The local computer will search for an application that understands files in the **.doc** format. It identifies Microsoft Word as an application that understands **.doc** files, starts Word running on the local computer, and downloads **Homework10.doc** into Word. The document can now be manipulated with Word just as any other local document. It can be saved to a local drive using the normal save procedure in Word, but it cannot be saved to the Web site.

Downloading and Saving a Data File

The following example shows how to download a data file from a website. The file we want to transfer to the local computer is a data file to be used in a C++ programming assignment. The file name on the website is **InputData.dat**. The **.dat** extension indicates that this file contains data. Files with the **.dat** extension are not usually associated with any specific application and therefore cannot be opened from the website. The file is located on the **pua.edu** website in the folder **/courses/cpt/cpt250**. The goal is to change the file's name to **Proj3Input.dat** and save it in the **/Documents** folder of the local **C:/** drive. Begin by starting the browser and entering the complete URL and path of the file: **http://www.pua.edu/courses/cpt/cpt250/InputData.dat**. The browser will start the *File Download* wizard. The first screen offers the user two option buttons; *Open this file from its current location* and *Save this file to disk*. Select the *Save this file to disk* option. The next screen is the *Save As* dialog box. Click the down arrow to the right of the *Save In:* input box and double click the **C:/** drive. A list of all folders available on the **C:/** drive will appear. Double click on the **Documents** folder. The folder will open, and its contents will be displayed in the window. Type **Proj3Input.dat** in the *File name* input box and click the *Save* button. As the download begins, the wizard will display a status screen that shows the file source and destination information, the estimated time to complete the download, and the data transfer rate. When the download is complete, the screen will show statistics on the download process. The file is now in the folder **C:/Documents/**, under the name **Proj3Input.dat**. Verify this by opening Windows Explorer and viewing the contents of the **C:/Documents** folder.

Conclusion

The Web is an information source that offers many faculty – student communications opportunities. Both faculty and students can benefit from the on-demand information availability the Web offers. The Web support features included in today's personal productivity software will allow faculty to develop basic Web content with little or no additional effort. These features, used in conjunction with the existing Web presence of most institutions provides a framework on which faculty can grow course support with little or no Web development experience. This places Web course support within reach of most faculty.

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Designing and Developing Rubrics As An Instrument to Assess ISTE's (International Society for Technology in Education) National Educational Technology Standards for Teachers (NETS-T)

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Abstract

Last year, the International Society for Technology in Education (ISTE) worked to develop and improve teacher skills in the area of educational technology by creating technology performance profiles for teacher preparation. These standards were given to a group of PSU instructional systems graduate students who developed rubrics to assess the four categories of standards. The process and methods used in the design, development, and creation of these rubrics will be presented and discussed, and the rubrics will be available for use by the participants.

Introduction

Assessment has always been an important part of both the education and training fields. Standards are also valuable way of defining expectations, but when it comes to assessing whether standards have been achieved the plot thickens. Issues that arise concerning the reliability and validity of measurement and assessment will always be present. Assessment instruments are not always easy to design or develop. Some assessment instruments such as rubrics can be of some help. Rubrics are designed to "focus on measuring a stated objective (performance, behavior, or quality), use a range to rate performance, and contain specific performance characteristics arranged in levels indicating the degree to which a standard has been met." (Pickett) A rubric may be applied in many situations and score criteria that is, "summative, by providing information about a student's knowledge, formative, by providing information about a student's strengths and weaknesses, evaluative, by providing ways to create instruction that better fits each student's needs, and educative, by providing students with an understanding of how they learn." (Luft, 1997) Rubrics evaluate and measure a learning situation using a holistic or analytical approach that ideally results in the creation of an easy to use matrix of learning targets and the level at which these targets are achieved. The number of categories and levels of mastery is always up to the creator(s) of the rubric.

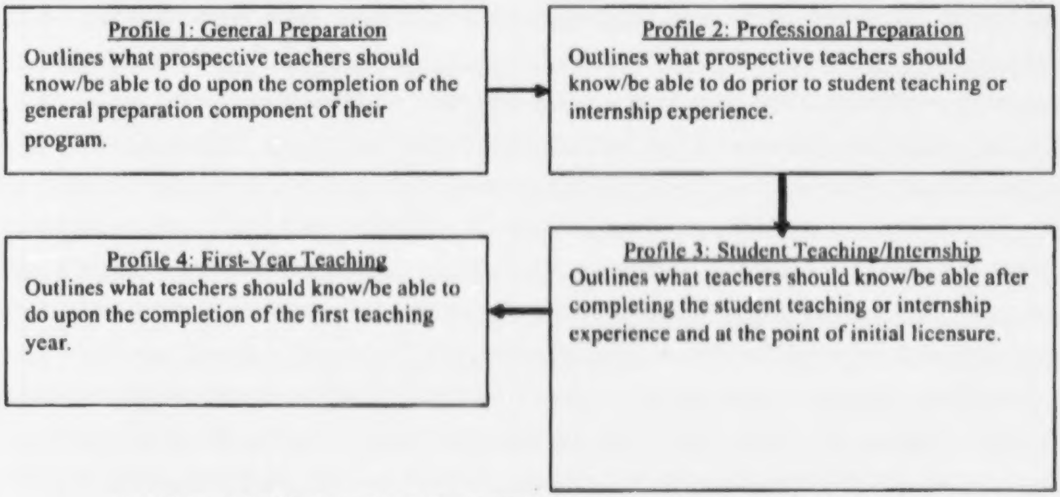
This presentation discussed the use of rubrics as an instrument to assess standards. The National Educational Technology Standards (NETS) project writing team has created and defined technology performance profiles for teacher preparation across four categories in hopes to use these profiles in the development and improvement of teacher skills and competencies in the area of educational technology (http://cnets.iste.org/pdf/nets_brochure.pdf). This project, initiated by the International Society for Technology in Education (ISTE), focused on the development of national standards for various uses of technologies that are associated with school improvement in the United States. A group of graduate students at Penn State University, taking a class based on analyzing outcomes and learners, given these standards and charged with developing assessment instruments based on the ISTE standards. This presentation explored the design and development of those assessment instruments.

The presentation began with a brief introduction and statement of objectives. We then explored the work done by the ISTE NETS writing team with the intent to engage the audience in the specific areas addressed by these standards. We then explored the four categories of standards, general preparation, professional education, student teaching/internship, and first-year teaching and the suggestions for evaluation provided by a class well versed in analyzing learners and outcomes. We looked at separate rubrics the class constructed and examined how they relate to the original standards. We discussed the design and development of these rubrics and the processes, obstacles, and methodologies in which these assessment instruments were created. The presentation ended with an open forum and a brief question and answer period between the audience and the presenters.

The format of this presentation recommends a refined approach, used for creating and implementing rubrics, as an appropriate instrument of assessment, specifically when evaluating performance based on the ISTE's National Educational Technology Standards. The audience was expected to offer constructive criticism and suggested ways to improve upon the processes and methods used.

The NETS-T Project

- The National Educational Technology Standards for Teachers (NETS-T) is an International Society for Technology in Education (ISTE) initiative, which seeks to prepare today's teachers-in-training to provide technology-supported learning opportunities and interventions for K-12 classrooms.
- This initiative is funded by a United States Department of Education's Preparing Tomorrow's Teachers to use Technology (PT^3) Grant, a catalyst program designed to train technology literate teachers.
- Accordingly, NETS-T defines technology knowledge and skills, as well as attitudes new teachers should possess as they proceed through their teacher preparation programs.
- Each performance standard outlined in each of the four profiles is designed to assess ISTE's National Education Technology Standards (NETS) and their corresponding Performance Indicators for teachers.
- To facilitate this process, ISTE developed four profiles of technology literate teachers, each of which details the required technology knowledge and skills at the following stages of preparation:
  - Completion of the general preparation
  - Prior to internship/student teaching experience
  - After completion of internship/student teaching
  - Upon completion of first year



Profile 1: General Preparation
Outlines what prospective teachers should know/be able to do upon the completion of the general preparation component of their program.

Profile 2: Professional Preparation
Outlines what prospective teachers should know/be able to do prior to student teaching or internship experience.

Profile 3: Student Teaching/Internship
Outlines what teachers should know/be able after completing the student teaching or internship experience and at the point of initial licensure.

Profile 4: First-Year Teaching
Outlines what teachers should know/be able to do upon the completion of the first teaching year.

*Additional details for each profile are available at http://cnets.iste.org/pdf/nets_brochure.pdf and at the ISTE website http://www.iste.org.

Why We Did It

- Kyle Peck, Ph.D., Professor of Education in Instructional Systems, assigned the assessment of the NETS-T, in partial fulfillment of a required graduate course in assessments.

- He felt that this project would both provide a real-life opportunity as well as be of practical value to ISTE's efforts, which, to that date, had not created a comprehensive assessment strategy for this initiative.

How It Was Done

- For the most part, students were able to choose the Profile that they wished to develop assessments for.
- We were given the freedom to organize the performance standards such that it was deemed manageable.
- This meant combining, re-writing, and even removing performance standards that did not fit in with the respective graduate students assessment plan.
- Accordingly, it is safe to say that no two-assessment products within each profile were the same.

Examples
Profile #2: Professional Preparation

Description

Learning Target III: Teaching, Learning and Curriculum (ISTE NETS Performance Indicators: I, III, IV,V)

Performance Objective*: **The teacher will be able to design lessons and peer teach with technology that meets the content standards and reflects the best practices in teaching and learning.***

Performance Standard: Having observed teaching practices in various schools, video demonstrations and other peer teaching, the teacher will be able to design and teach lessons that reflect the best practices in teaching and learning using technology

Assessment Method: Lesson Plans and Teaching Practice

Performance Task: Design and teach technology enriched learning activities that maximize student leaning with diverse needs.

Learning Target I

Elements of Assessment: Knowledge of Technology Concepts, Tools and their Uses.

This is a 'to do activity' for your professional development.
There are three sections numbered A, B, C. Please follow the instructions carefully.

A. Technology Concepts.

i) Assessing your conceptualization of technology-related concepts.

Directions: Work through this activity and construct your own personal concepts about technology. Circle T or F to indicate what is True or False, and write an explanation if required.

1. The terms 'medium for instruction' and 'instructional technology' are synonyms.
   T or F
2. There is a difference between interactive technologies and presentation technologies.
   T or F
3. Printed textbooks are technology tools for delivery.
   T or F

4. There is no significant difference in learner achievement between those who are taught with the Internet and those taught with traditional methods.
T or F

Explain your answer.

ii) Assessing Personal Attitudes Towards Technology

Directions: Place an "x" on the continuum to represent your feelings towards the statements below.

1. Technology should be integrated into teaching and learning from the cradle to the grave.

Agree Uncertain Disagree

2. New technologies for use in the classroom are more important than traditional basic supplies.

Agree Uncertain Disagree

3. Computer-mediated teaching will soon make teachers redundant.

Agree Uncertain Disagree

4. Today's learners, who are more literate than their own teachers, threaten me.

Agree Uncertain Disagree

5. I am not confident with my skills to try new technologies.

Agree Uncertain Disagree

6. Today's learners, who are very computer savvy, are less creative than learners who are less exposed to computers.

Agree Uncertain Disagree

C. Technological Tools

Assess your knowledge of Technological Tools.

In the second column of the table below, place a checkmark next to the technological tools that you are comfortable using and make a cross by those you would like to be able to use. In the third column, give your comments on how you plan to improve your skills to use those tools.

Medium	Technology tools for Delivery	Comments for Improvement
Face-to-Face contact	Presentation Aids: Black or white board _____ Overhead projector______ Data projector__________ Slide projector__________	
Text (including graphics)	Printed textbook____ Web-based textbook__ Facsimile____ Computers___ (Including a range of applications such as e-mail, electronic databases, World Wide Web hypertext documents, FTP or ASCII documents, CD-ROM)	
Audio	Audiocassette____ Radio broadcast______ Telephone___ Computers (with related applications)____	
Video	Television Broadcast (Terrestrial, satellite or cable and including narrowcast educational television)_____ Videocassettes_____ Video disc_______ Videoconferencing___	
Integrated Multimedia	Computer-mediated learning environments____ *(This could be stand alone or networked and with numerous possible ways to access all media through a single technology)*	

Knowledge of Computer Operations

Directions: In the right-hand column, circle the letter(s) that indicate your knowledge about computer uses.
K = I Know DK = I Don't Know

Graphic User Interface	Performance Task		
Use of toolbar, menus, and dialog boxes	Locate and use features on a toolbar. Locate and select items on menus. Locate and respond to dialog boxes.	K	DK
Menu Shortcuts	Identify and use menu shortcuts.	K	DK
Selecting	Select tools and other features within a GUI.	K	DK
Click, Double Click/Right Click,	Demonstrate clicking, double-clicking, right clicking (on PC), command clicking (On MAC), and dragging.	K	DK

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Drag			
Window	Identify and use the functions of a window.	K	DK
Scrolling	Scroll up and down a window.	K	DK
Resizing	Resize a window.	K	DK
Closing	Close a window.	K	DK
Application Software	Performance Task		
Launching	Launch an application.	K	DK
Creating files	Create a file.	K	DK
Saving	Save a file.	K	DK
Common features	Identify the features that most applications have in common.	K	DK
Basic four productivity applications	**Performance Task**		
Word processing	Demonstrate the use of a word processing application.	K	DK
Spreadsheet	Demonstrate the use of a spreadsheet application.	K	DK
Database	Demonstrate the use of a database application.	K	DK
Graphics	Use a graphic application.	K	DK
File Management	**Performance Task**		
Saving a file on a hard drive	Save a file on a hard drive.	K	DK
Saving a copy of same file at different location	Save a copy of same file at different location.	K	DK
Creating file folders	Create a new file folder. Save/Move files to a folder.	K	DK
Finding a directory from a pathname	Find a directory from a pathname.	K	DK
Naming conventions	Recognize and use file -naming conventions (as they may appear on a MAC and a PC). Explain the importance of using the correct naming conventions.	K	DK
File Recovery	Identify and demonstrate the methods available to recover files and lost data.	K	DK

Teaching, Learning and Curriculum

Element of Assessment: Lesson Plan and Teaching Practice Using Technology
Performance Task: Design and Teach Technology Enriched Learning Activities That Maximize Student Learning With Diverse Needs.
Name of Rubric: Checklist for Lesson Observation and Assessment Using Interactive and Presentation Technologies

Last Name:...**Initials:**..................
Student Id:...........................
Program of Study:..................................
Subject:...**Topic:**...
....
Grade:.................. **Date:**................ **Time:**..........
Signature of Evaluator/Observer:................................ **Marks:** 5 x 2 = ... *10 (Each element carries 2 marks)*

A. LESSON PLAN PREPARATION

DESCRIPTORS	**COMMENTS**

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Appropriate technological tools were chosen. Technology relevant to the topic and logically integrated in the lesson.	

B. LESSON PRESENTATION

DESCRIPTORS	COMMENTS
Effective and skillful use of technological tools Technology chosen is purposeful and gained immediate attention from the class. Achieved appropriate content of the lesson.	

C. HANDLING OF TECHNOLOGICAL EQUIPMENT

DESCRIPTORS	COMMENTS
Knew all the operations of the technological tools	

D. SENSITIVITY TO DIVERSE NEEDS

DESCRIPTORS	COMMENTS
Technology used was sensitive to the special needs of individual identities. Technological tool used communicated to different sectors of the class.	

E. GENERAL IMPRESSION OF THE STUDENT TEACHER

DESCRIPTORS	COMMENTS
Used a variety of technological tools and looked confident, enthusiastic and enjoys teaching with technology.	

AECT Presentation Conclusion

The presentations were based on the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) for Teachers.

The class included students from varying professional backgrounds. We believe that all students, regardless of professional and academic background, found the assessment of these standards important to the success of their implementation. In evaluating these standards, most students found that creating an assessment process was difficult because it involved a great deal of compromise as well as huge amounts of time to complete the assessment of a standard.

Despite the difficulties it was an extremely rewarding process because we were given experience of the difficulties and challenges inherent in any educational assessment.

Strategies for Building Integrated EPSS

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Abstract

Because the complex link and node structure awaiting users can lead them into becoming lost in hyperspace and cause them cognitive overload, navigating the hypertext system is often not an easy task, especially for novices. They have a difficulty perceiving a structure a structure of entire system, locating specifying information, using navigational aid. This phenomenon can be more expected in the highly structured EPSS. In that point, content providers or designers for web-based integrated EPSS should know how to design interface and information structure based on its content and purpose.

This study analyzed four interface design methods (simple selection menu style, menu with global navigation, menu with global and local navigation, and pull-down menu) and four information structures (linear structure, grid, hierarchy, and network) in terms of the complexity, flexibility, navigation, domain knowledge, and cognitive load. Based on this analysis, guidelines for building the integrated web-based EPSS effectively are provided.

Introduction

Building an effective EPSS has been a major issue not only in business but also in education and government. As more people come to depend on the use of computers and networking to perform their jobs, and as hardware and software technologies continue to advance, the potential for EPSS appears tremendous (Collis & Verwijs, 1995; Malcolm,1998; Ockerman et al., 1997).

Hypertext and hypermedia system enabled designers and programmers to tile all performance support system elements together in a way that allowed users to follow their own streams of thought in searching for information (Gery, 1991). Hypertext is such a technology that provides a powerful new way of organizing, displaying, and accessing information that could affect all forms of systems (Shneiderman and Kearsley 1989). Hypertext consists of the associative links between multiple nodes, which are one or more parts of information, forming an interconnected networked (Nelson 1974; Conklin 1987). The linking system in the hypertext system allows users to browse through the system utilizing navigational tools (Eklund 1995). However, navigating the hypertext system is often not an easy task, especially for novices (King, 1996). The potentially complex link and node structure awaiting users can lead them into becoming lost in hyperspace (Nielsen 1990) and cause them cognitive overhead (Conklin, 1987). Users have a difficulty perceiving a structure of entire system, locating specifying information, using navigational aid. This phenomenon can be more expected in the highly structured EPSS.

Such problems have prompted research on the manner in which users interact with hypertext system. Usable design guidelines and principles for navigation can maximize coherence of integrated EPSS and minimize users' cognitive overhead and disorientation.

Interface design

When designing an integrated EPSS, two important issues are involved: 1) interface design - how to present link system that provide access to the structure, and 2) information structure - how to incorporate the original structure of the content into the structure of an EPSS.

Interface design is basically concerned with the presentation of text, graphics, and linking system on the screen. It provides a contextual or structural model for the specification of the logical and functional organization of the user interface component, as well as a communication and means between users and system (Laverson, Norman et al. 1987; Norman and Chin 1988; Lai and Waugh 1994; Oliveira, Goncalves et al. 1999). Many researchers has been agreed that interface should be designed to provide users efficient and effective organizational model that can help users understand the entire system and navigate system to find information without getting lost or cognitive overload (Lai and Waugh 1994; Dieberger 1997; Shneiderman 1997; Schenkman and Jonsson 2000).

Interface on an EPSS provides three major roles for navigation; 1) presenting links, 2) supporting structural cues, and 3) providing path mechanism. The interface is the most immediately visible part when a system was user-centered (Nielsen 1990). The most fundamental function of interface is to display links one the screen so that a user could navigate through a system (Shneiderman 1998). Selecting the links is frequently difficult to navigate in spite of the fact that a graphical browser provides the easy to navigation method, "point and click." One factor of difficulty in selecting paths for navigation is the presentation of link system. The user navigation performance can be influenced by the design and placement of links (Carlson and Kacmar 1999).

The second role is to support the user perception of structural cues for an effective navigation. If the interface does not provide appropriate structural information, users cannot perceive where they are and cannot decide where to go. Users also could experience "lost in space" (Dieberger, 1997).

Information is structured by links and users follow paths developed by designer. As a result, if interface design provides the flexible path mechanism that can allow users to jump to the information directly without passing pages that are not necessary to get the information, users could find information fast. However, there is some possibility to increase user's cognitive load without providing structural and navigational cues.

There are four generally used interfaces for navigating the web site: 1) simple selection style, 2) global navigation aid, 3) global and local navigation, and 4) pull-down menu styles.

1) Simple Selection Menu Style

One type of menu style is simple selection menu style, which is much similar to a table of contents for a print book (Chimera and Shneiderman 1994). In this menu style, a user can go to deeper levels of the web site by selecting links presented in the current web page. The major drawback of this menu style is that a user has a difficulty in perceiving the entire structure of the web site (Chimera, 1994), since when a user moves into lower levels, previous menu is replaced with new level. Another drawback of this menu style is that a user is unable to traverse to beyond below level because a user has to wait for a new below level select link again before moving lower level and select the link below level again. An experienced user is unable to navigate faster than that that of novice and this is inefficient and frustrating for experienced users (Laverson, 1987).

2) Global Navigation Aid Menu Style

The second menu style is persistent menu that has two split parts. The links on the top level remain in the similar area on the left all the time. The content is located in the area on the right and is replaced by its subsequent menu when users move other pages. The advantage of this menu style is that a user can go to each page of the top level by clicking top level links on the left side from any page in the web sit and that it provides the global structural cue to users (Nanard and Nanard 1991).

3) Global and Local Navigation Menu Style

The third menu style has two parts of navigation link for global level and local level (Nanard & Nanard, 1991). The navigation links of top-level pages on the web site usually place on the top of web page and the navigation links of current level pages on the web site usually place on left side. The advantage of this menu style is to provide not only global structure cue with the top-level navigation links but also local structure cue with current level navigation links (Furnas 1997). A user can skip several levels in the web site and it can more efficient than other menu design because a "jump-ahead" capability can reduce the time to navigate and find information (Laverson, 1987).

4) Pull-Down Menu Style

Pull-down menu style appears over objects in the interface instead of in static menu area. Pull-down menu allow users with a mouse to access the Web page they want directly. The advantage of the menu style is jump to the any page with mouse move and click. However, users can be disoriented or get lost since this menu can't provide structural cues. This menu style would be useful for experienced users.

Table 1. Summary of Menu Style

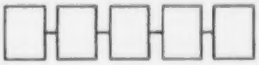
	Use	Complexity	Flexibility	Access Speed	Disorientation
Simple Selection	Easy	Low	Low	Slow	Low
Global Navigation	Easy	Middle	Middle	Middle	Middle
Global & Local Navigation	Hard	High	High	Fast	High
Pull-Down	Middle	Very High	Very High	Very High	Very High

Information Structure

The structure of a hypertext system can take many different forms. Four basic structures are linear, grid, hierarchical, and network structure. However, a web-based integrated EPSS can be designed with more than one structure.

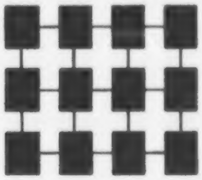
1) Linear Structure

The simplest way to organize information is in a sequence based on chronological or logical orders. Typically it is useful structure to retain the original documentation. Linear structure can be used for guided tour, job aids, tutorials, and demonstration of procedure in Web-based EPSS.



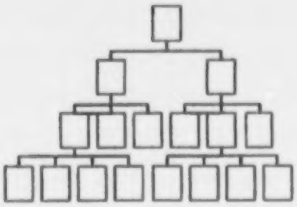
2) Grid

Grid structure organizes multi-dimensional concepts or categorizations. A serous of procedural manuals and list of training courses and materials can be best organized. Grid structure can be organized with one concept or categorization in horizontal axis by vertical axis with other concept or categorization. Unfortunately, grid structure can be difficult not only to organize but also to understand unless the designer or user recognizes the interrelationships between concepts and categorizations of whole information. Therefore, it is best for who already have knowledge on topics and its organization (Lynch 1999).



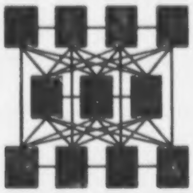
3) Hierarchy

A hierarchical structure bas been used widely in the web site (Lynch, 1999), on-line documentation (Gloor 1997), information retrieval system (Rosenfeld and Morville 1998), and computer-based instructional programs and training (Lai, 1994; Jonassen, 1986). Organization of hierarchical structure starts with general concept or topic into specific ones, which are in turn divided into more specific to individual based on precedence and significance (Lynch, 1999; Norman, 1988; Sano, 1996). Users can move from general to specific and back to general through the linking system presented by menu design. The advantage of hierarchical structure is that familiar to most people since it reflects the structure of printed materials (Shneiderman and Kearsley 1989), it is ubiquitous in everyday life (Sand 1996), and it is the most natural structures for organizing levels of abstraction (Gloor, 1997). Because of its familiarity and pervasiveness, users can easily and quickly understand web sites and hypertext system (Rosenfeld, 1998) without heavy cognitive overload. In organized hierarchical information structure, the disorientation problem can be minimized and users can easily navigate among information nodes by following the linking system (Conklin, 1987). They are able to develop a mental model of the site's structure and their location within that structure (Rosenfeld, 1998).



4) Network

Network structure is composed of associative links that network related concepts and information together. While this structure provides relatively effective navigation mechanism, users can easily get lost or disoriented because it is so hard for users to understand and predict entire. This structure can apply on small size of Web site for high level of training, such as simulation game, strategy training. It would be difficult to manage linking system if size is getting bigger (Lynch, 1999).



Most complex web sites share aspects of all four types of information structures. Except in sites that rigorously enforce a sequence of pages, users are likely to use any web site in a free-form "web-like" manner, just as most non-fiction or reference books are used. But the nonlinear usage patterns typical of web surfers do not absolve developers of the need to organize their thinking and present it within a clear, consistent structure that complements design goals for the site. Table 2 shows the characteristics of four basic organization patterns explained above in terms of the complexity, flexibility, easy-to-navigation, domain knowledge, and cognitive load.

Table 2. Summary of Information Structure

	Complexity	Flexibility	Navigation	Domain Knowledge	Cognitive Load
Linear	Low	Low	Very Easy	Low	Low
Grid	High	High	Middle	High	High
Hierarchy	Middle	Middle	Easy	Middle	Middle
Network	Very High	Very High	Hard	Very High	Very High

Depth and Breadth

The most discussed issues in information structure are branching factors, depth (the number of vertical levels or links) and breadth (the number of horizontal documents or links) (Shneiderman 1997). Much has been known about tradeoff of "depth and breadth ", and "complexity and flexibility issues (Larson, 1998; Shneiderman, 1997). The previous results generally support that deeper hierarchical structure, the less helpful and less favorable for navigation. Users have to move through more levels to located information in the deeper structure and should need more not only cognitive effort but also physical effort to interact with more displays and links for information searching (Shneiderman, 1989).

Guidelines for building an integrated EPSS

Design of integrated EPSS can be affected by many factors. These factors include as follows:

1) Analyzing the nature of information or knowledge

In building an effective web-based integrated EPSS, one of the most important things developers have to keep in mind is to analyze the nature of information or knowledge to be supported by the site as exactly as possible. Depending on the professional medical knowledge with a complex information structure or the general knowledge with a simple information structure for its delivery, it might be totally different in terms of the interface design, information structure, and the depth and breadth of the information.

2) Analyzing user characteristics

In order to build an effective web-based integrated EPSS, developers should clearly analyze the characteristics of the target users of the site. That is, the developers need to make a more detailed analysis of the target audiences, such as teenagers, professionals of some fields, and so forth. Based on that analysis, the developers can grasp the major concerns of the audiences and predict their preferences. This will lead to providing appropriate functions just in time when such needs arise. If the EPSS is developed without considering the users' characteristics including their preferences, the site, no matter how well organized or useful, will not appeal to the some portion of the users any more.

3) Localizing contents and categories

Due to the rapid development and spread of communication technology, traditional borders disappeared in the terms of information sharing. In other words, we can share any content as soon as it is developed. Considering the importance of sharing information, this is very desirable. The problem arises for the fact that every country has unique cultural and social context as well as different language. Even in the same country, there can be various cultural groups. Certain problems are expected in the use of certain contents in different countries or cultural groups. For example, item 'I', which is categorized as 'A' in one country, can be categorized as 'B' in another country. There is a need to readjust contents or categories in terms of cultural and social contexts. The easiest solution is to prepare different versions for different groups. Here, the developers may most likely face the effect of tradeoff due to additional cost.

4) Analyzing client system capability

The developers need to be cognizant of the system environment under which the users are learning. This is closely associated with analyzing users characteristics. While the latter is more concerned with physical and affective characteristics of the users, the former is more focused on their learning milieu. With the rapid development of technologies, we have recently seen many products with newly-added features. Even the products marketed in the same year maybe different from one another in terms of system capability. In this vein, the developers need to continue their analysis on the learning environment of the users.

5) Analyzing information accessibility

We cannot overemphasize the importance of information accessibility for building an effective web-based integrated EPSS because the EPSS is delivered via electronic telecommunication technology like Internet. While most users with intent to access to Internet use LAN in their office, they rely on modem at home. So, their major concern is how expeditiously and conveniently they can access the needed information. When they cannot obtain the information they need at their convenience, they will experience inconveniences arising from the use of the site. This will eventually turn the users away from the site. Therefore, high level of information accessibility is very important factor of a successful EPSS.

6) Planning information updatability

Information updatability is another critical issue. In EPSS, this factor is more important than any other fields, because the users want information, which is most recently updated at their convenience. In this regard, two most important issues arise as to how promptly the information can be updated and who will assume the role of updating the information.

7) Harmonizing internal relationships between other information sources

Information in EPSS is sophisticated rather than fragmentary. As seen in Figure 1, even the same types of information can be restored and delivered in various ways. Some information can be delivered by visual formats such as text or graphics or by audible formats such as audio. In this sense, harmonizing internal relationship between other information sources is very important. If the internal relationship is not well organized, the EPSS is just an archive of unrelated, individual information.

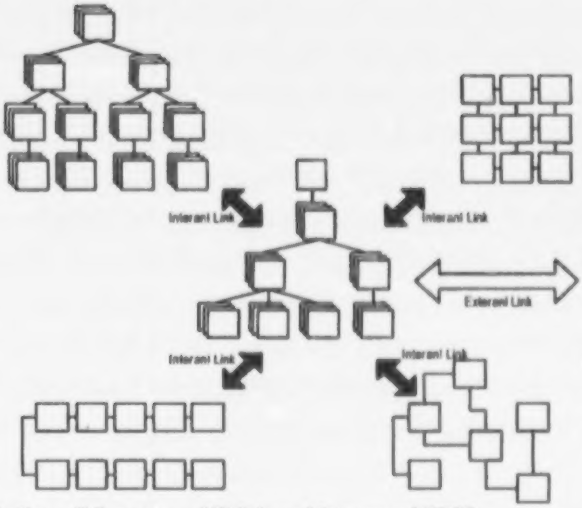


Figure 1. Overall Structure of Web-based Integrated EPSS

8) Integrating external relationships between other EPSS

Finally, integrating external relationships between other EPSS is another important issue. The developers should consider that the EPSS has to be related to external sources at some degree in order to maximize its effectiveness. Just as harmonizing internal relationship between other information sources was important, integrating external relationship between other EPSS in a harmonious way is a very important factor of successful EPSS.

All of these factors impact the way to present and structure the web-based integrated EPSS. In order to maximize the usability of web-based integrated EPSS, therefore, we need to identify and select appropriate menu systems and information structures.

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Problem-Based Learning in Web-Based Science Classroom

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Abstract

The purpose of this presentation is to discuss how general problem-based learning model and social-constructivist perspectives are applied to design and develop a web-based science program, which emphasizes inquiry-based learning environment for 5th grade students. The presentation also deals with general features and the learning process of web-based science program, including teacher's action, the student's learning activity, and cognitive tools to scaffold the student's inquiry. A major goal of PBL in web-based science program is to help students' construct scientific thinking and problem solving skills through a set of interaction including teacher-to-student, student to-student, group-to-group, student-scientist, and student-cognitive tools. The main stages of PBL in web-based science program as a learning cycle are 1) "Your Challenge" which students engage in an authentic problem situation, 2) "Plan Inquiry" which students identify what they know, what they need to know to solve a problem, and how they go about finding out, 3) "Explore Resources" which students gather information, learn primary concepts and principles necessary to solve the problem, and contact with scientist to acquire scientific thinking process for solving problem and their perspective about the problem, 4) "Generate Alternative Solutions" which students come up with alternative solutions to the problem after analyzing information and data, 5) "Reflection & Presentation" which focus on feedback from teacher, students, and scientist about alternative solutions. After revising their solutions, students present their best solutions. In this learning cycle, scaffolding or cognitive tools support students' activity to communicate scientific arguments and to solve the problem.

Why PBL?

Problem-Based Learning provides minds-on and hands-on experience for students to engage in real world problem (Torp & Sage, 1998). During the Problem-based Learning, students (1) play the role of stakeholders in the problem scenario, (2) engage in an ill-structured problematic situation, (3) identify what they know and need to know, (4) define the problem to focus further investigation, (5) gather and share information related to the problem situation, and (6) generate several possible solutions and identify the solution of best fit (Torp & Sage, 1998; Savery & Duffy, 1996; Albanese, A. M., & Mitchell, S., 1993).

Hewitt and Scardamalia (1996) addresses the why PBL works.

- Inquiry is focused upon communal problems of understanding where meaning is negotiated through questioning, theory refinement, and dialogue.
- Students' ideas about what they need to know become the focus of inquiry.
- Knowledge is shared and held collectively. New information that is shared has the potential of shaping subsequent investigations by others.
- The artifacts of student inquiry are made public and used in knowledge production. These include problem maps that integrate information and highlight connections, graphic organizers that help visualize patterns and relationships, and loop writing that provides opportunities for students to respond to the thinking of their peers.
- Responsibility for planning, organizing, questioning, and summarizing is shared among the students and facilitated by the teacher.

Problem-based learning helps students develop and practice ways to solve problems that are in some way relevant to issues they can relate to. By allowing students to work through problems, they develop reasoning skills and are able to think through real problems more critically. Students are generating their knowledge by themselves with experiences and prior knowledge.

Providing teachers' space about how to coach will give teachers, who are using PBL in their teaching, idea how to scaffold and facilitate in PBL environments.

Why Web-Based?

In this learning environment, students should be provided feedback to responses made during the learning process. It may be necessary for teacher-to-student, student to-student, and group-to-group, to communicate in the same time frame and have coordinated access to the same World-Wide Web pages. In order to provide responsive feedback, web-based learning environment with interactive media (BBS or Email) is need (Dick & Carey, 1996).

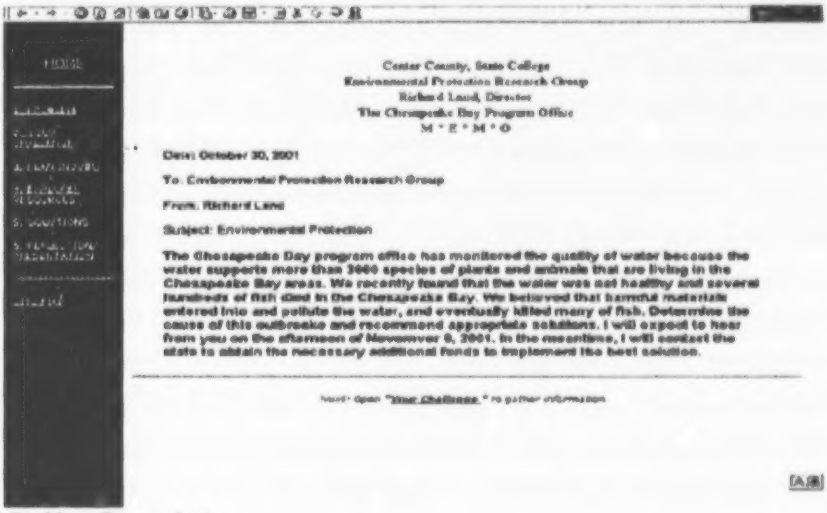
This is designed for classroom study with computers connected with the Internet. Internet will give students have full of chance to search resources. Another reason for choosing web-based learning environment is for any teachers, who have the Internet connection in their classroom, and who want to use this learning environment.

The purpose of this learning environment is to discuss how general problem-based learning model and social-constructivist perspectives are applied to design and develop a web-based science program, (comma) which emphasizes inquiry-based learning environment for 5th grade students. This project also deals with general features and the learning process of web-based science program, including teacher's action, the student's learning activity, and cognitive tools to scaffold the student's inquiry.

A major goal of PBL in web-based science program is to help student construct scientific thinking and problem solving skills through a set of interaction including teacher-to-student, student to-student, group-to-group, student-scientist, and student-cognitive tools. In this learning environment, teachers are active coaches, and students are active students.

Learning Stages of PBL

PBL is an instructional method characterized by the use of "real world" problems [Figure, 1] "Problem" as a context for students to learn critical thinking and problem solving skills, and acquire knowledge of the essential concepts of the course. Using PBL, students acquire life long learning skills, which include the ability to find and use appropriate learning resources. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources.



Center County, State College
Environmental Protection Research Group
Richard Land, Director
The Chesapeake Bay Program Office
M * E * M * O

Date: October 30, 2001

To: Environmental Protection Research Group

From: Richard Land

Subject: Environmental Protection

The Chesapeake Bay program office has monitored the quality of water because the water supports more than 3000 species of plants and animals that are living in the Chesapeake Bay areas. We recently found that the water was not healthy and several hundreds of fish died in the Chesapeake Bay. We believed that harmful materials entered into and pollute the water, and eventually killed many of fish. Determine the cause of this outbreaks and recommend appropriate solutions. I will expect to hear from you on the afternoon of Novemver 8, 2001. In the meantime, I will contact the state to obtain the necessary additional funds to implement the best solution.

Next: Open "Your Challenge." to gather information

Figure 4 Problem (Screenshot)

After meeting the real world problem scenario, students will be engaged in the five stages to solve the problem. The main stages of PBL in web-based science program for students are (1)

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"Your Challenge", (2) "Plan Inquiry", (3) "Explore Resources", (4) "Generate Alternative Solutions", and (5) "Reflection & Presentation

Your Challenge

Students engage in an authentic problem situation. In "Your challenge" stage, students assign the role based on problem scenario and situation by discussions and negotiations with other members of group [Figure 2]. Groups were made up of three to four students.

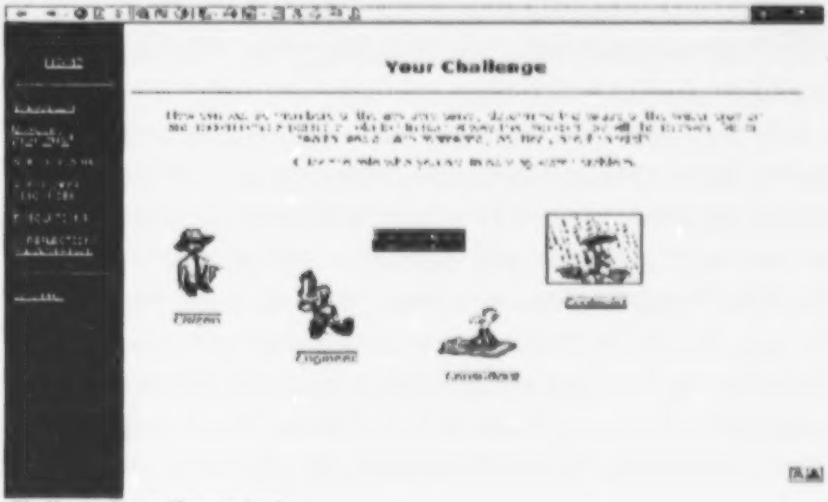

Figure 2 Your Challenge Stage (Screenshot)

Plan Inquiry

Students identify what they know, what they need to know to solve a problem, and how they go about finding out [Figure 3]. "I Know This" which students will have to prove what they know from meeting the problem

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Figure 3 Plan Inquiry Stage (screenshot)

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as well as from their experiences, and document the information on a "Know" chart. "I need to know this", which document what critical issues are to finding out more about the problem. Determine students' initial information gathering effort. "How do I get this" which determine how to get information, and how to hunches students have about what may be causing the problem or what may be part of the solution. Under the guidance of a teacher, the students must take responsibility for their own learning, identifying what they need to know to better understand and manage the problem on which they are working and determining where they will get that information. This allows each student to personalize learning so as to concentrate on areas of limited knowledge or understanding, and to pursue areas of interest.

Explore Resources

Students gather information, learn primary concepts and principles necessary to solve the problem, and contact with scientist to acquire scientific thinking process for solving problem and their perspective about the problem. Resources will be different by student' role, for example, ecologist will have and gather information that appropriate and relate information to him/her, so that student will became an ecologist.

Generate Alternative Solutions

Students come up with alternative solutions to the problem after analyzing information and data, and recommend solutions based on the information students have gathered using the Decision-Making Matrix [Figure 4]. From the information students have gathered, students will have to come up good judgments supported by criteria, context, self-correction, and explicit reasons for drawing a conclusion, note the strategy, pros, cons, and consequences which are discussed with your group member in the box, and assign a score to each pro or con, from 1 (weak) to 5 (strong) using the Decision-Making Matrix for the their final solution.

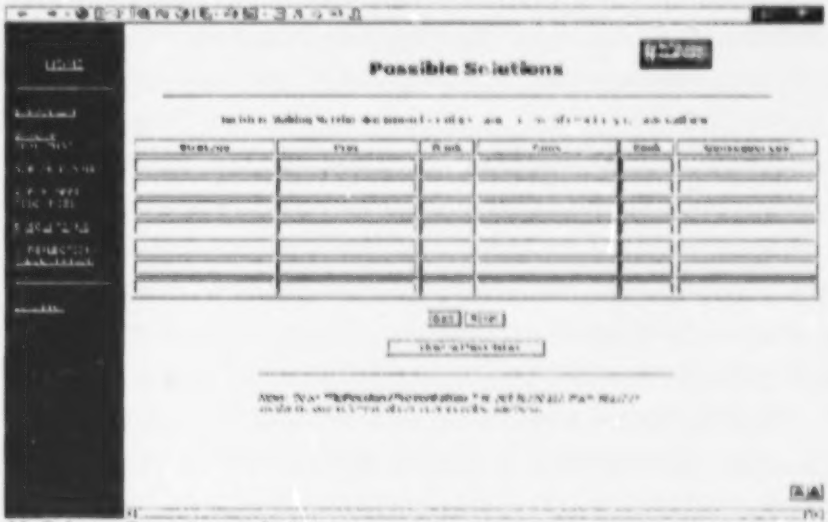

Figure 4 Possible Solution Stage (screenshot)

Reflection & Presentation

Focus on feedback from teacher, students, and scientist about alternative solutions [Figure 5]. After revising their solutions, students present their best solutions. After revising their solutions, students present their best solutions. When students finish each "Plan Inquiry", and "Solutions" they will show this stage. By clicking button, which is under "Plan Inquiry", and "Possible Solutions", each student can review other student's work. And send an e-mail to give feedback or comments.

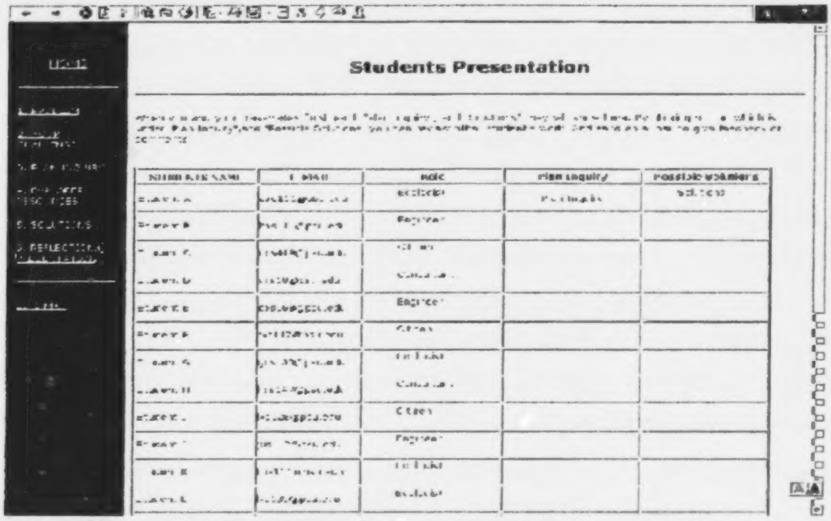

Figure 5 Reflection and Presentation Stage (screenshot)

Ask Teacher

In the stages of Plan Inquiry and Possible Solution, students will have "Ask Teacher" that works as a model for supporting students' work through the process of problem solving.

Teachers' guidelines

In each stages, teachers will have guidelines about "what is coaching" and "how and what do I coach?"[Figure 6]. The PBL teachers are facilitator or activators of the students' learning initiatives. Working to guide, motivate, and probe the students' reasoning process as they journey through the problems rather than to direct it is often a less comfortable role, and requires a blend of creativity, ingenuity, and flexibility in its implementation Designing problem-based learning in web-based environment is more beneficial to provide and

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Figure 6 Teachers' Guideline (screenshot)

support scaffolding. Most web-based instruction just ignores the teacher's role and interface. We can hardly capture the teacher's work place in the web-based learning. Teachers just give students feedback. However, teachers only guide students through the process of problem solving, and they provide no direct answers for the questions. Teachers using PBL face the difficult task of guiding without leading, assisting and directing. Teachers' work in PBL involves guiding students through the process of developing possible solutions, and determining the best solutions with the justification.

Teachers' role should be in form of questioning, cueing, prompting, coaching, modeling ideal performance, mentoring, telling or discussing. Teachers can maintain joint attention on a goal by adopting PBL process, using role and drama, managing group work, and monitoring student engagement.

If student provides an accurate but incomplete explanation, teachers are likely to provide a recast or expansion of the student's explanation. Teachers deliberately plan their presentation of problems to facilitate the asking of though-provoking questions that involve the comparison of different problems or problem-solving techniques.

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Engaging Online/Web-based Learning Students in Discussion

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Introduction

"Discussion" according to The American Heritage College dic•tion•ary (1997) is "a formal discourse on a topic." Likewise online discussion is a formal discourse on a topic; however, it is done electronically either synchronously or asynchronously.

Online/web-based course instructors often find that they have more discussion with their online students than their classroom students (Ekhaml, 2000). However, there is still a perception that online/web-based learning is too textual, requires the student to learn on his/her own, and alienates students from the instructor and other students in the class (Hutton, 1999). For these reasons, discussion is important to an online/web-based course. Discussion helps reduce feelings of isolation, facilitates a spirit of community, and supports achievement of course goals. Being able to engage students in discussion that relates to the course when teaching an online course can sometimes be a challenge. Keeping the discussion to the topic can be an even bigger challenge.

As with traditional face-to-face classes, in electronic/online classes there is instructor-to-class discussion, student-to-instructor discussion (and vice versus) and student-to-student discussion. Fortunately, technology provides several media that supports efforts to engage students in discussion. Discussions can be conducted with email, threaded discussion, synchronous chat, list serves/bulletins, and planned face-to-face meetings.

Ways in which online discussions can occur

Email

Email enables the instructor to communicate with one or many students asynchronously. In addition, to giving specific feedback to queries from students, the instructor can email announcements or content-related information to the students. Email can also be used for office hours – students can email the instructor during the specified office hours and know that a response is forthcoming within the confines of the office hours.

Often students will communicate more frequently with an instructor via email than they do face-to-face when in a traditional classroom. Additionally, students can interact with one another via email. Students can submit individual assignments, work collaboratively on assignments, request technical assistance or query the instructor about content-related issues via email. Instructors can return assessments to assignments, provide support for technical and/or content-related issues, and make announcements via email.

A consideration to communicating via email is that students tend to want the responses to be immediate; i.e., within hours or the same day. The instructor should make clear how often email is retrieved and provide a timeframe in which students can expect a response. Another consideration to using email is the use of language. Students tend to communicate differently when communicating via email. For example, their frustration may read like anger, statements originally meant to be humorous may be offensive, and persistence may appear to be coercive. To minimize frustration and misunderstanding the instructor should identify expectations for communicating via email. The instructor should be sure to tell students the timeframe that responses will be given to their emails and whether responses will be given over the weekends and during semester breaks. Also, a few rules of Netiquette with the students are helpful. A few rules of Netiquette regarding email include

- Never say in email what you would not say to your reader's face
- Be ethical
- Proofread before clicking the send button
- Do not type in all capital letters; it reads as though you are shouting
- Be polite
- Be concise
- Fill in the subject line
- Avoid spamming
- Include a signature line that contains your full name, telephone number, office address, and email (The Netiquette Home Page http://www.albion.com/netiquette - available 11/4/01and Dark Mountain's Netiquette Guide http://www.darkmountain.com/netiquette - available 11/4/01)

The use of emoticons and acronyms in email are also useful. They enable the writer to say something or portray an emotion concisely; for example, AFAIK means 'as far as I know', NRN means 'no reply necessary' and POA means 'point of advice'. (Netiquette Home Page-A Service of Albion.com; available at http://www.albion.com/netiquette - 11/4/01, Dark Mountain's Netiquette Guide; available at http://www.darkmountain.com/netiquette - available 11/4/01)

Listserves/Bulletins

Listserves are similar to email in that they are asynchronous. Unlike email everyone that is a member of the listserve receives the submissions to the listserve. List serves/Bulletins support structured or unstructured discussion.

Threaded Discussions

As with email, threaded discussions allow the student to have discussion with the instructor as well as with classmates. Because threaded discussions are asynchronous, students can give careful consideration to their responses and post them at their convenience. When focused on a specific topic, the discussion can be quite engaging. To keep the discussion on track, online instructors can design questions that pertain to a particular article or class reading thus requiring students to focus on the course content for the discussion. Narrowing the topic to address specific questions related to the course content helps to keep the discussion from becoming fragmented (Ko & Rossen, 2001). Beaudin (1999) suggests that online instructors write questions that specifically elicit on-topic discussion, provide guidelines for on-topic responses, reword the original question when responses are no longer on topic, and provide a discussion summary. Another means of keeping the discussion on track is for the online instructor to respond to the students' responses. Students look to see if the instructor is engaged in the discussion and pattern themselves accordingly. According to Ko and Rossen (2001), "when students see that an instructor only rarely engages with them, they are discouraged from posing questions and comments aimed even indirectly at the instructor, and they may conclude that the instructor will be unaware of what is going on in the classroom" (p.227).

Regarding student responses, the instructor can provide guidelines for this as well. Guidelines might include having students:

- Respond in complete sentences with little no errors in spelling, grammar and punctuation
- Indicate support for their response from the assigned reading or other literature
- Respond a minimum number of times and with more than a mere 'I agree with ...'
- Respond within a certain timeframe (e.g., one week) to ensure that the discussion does not linger and loose its momentum all together.

In some instances, the online instructor may feel it necessary to assign points to contributions to threaded discussions. Specific criteria regarding participation should be detailed in the course syllabus. The grading criteria can be based on the quantity as well as the quality of participation. Regarding quantity, the instructor might require that students post a comment or question to the discussion within a specified timeframe (Ko & Rossen, 2001). The quality of the responses might be assessed on how well students address the question by paraphrasing information from the readings and citing/quoting supporting literature.

Activities that are supported by threaded discussion include online debates, case studies, article discussions, collaborative projects, guest speakers, and open discussion (Ekhaml, 2000). Each of these activities with the exception of the open discussion requires that there be a topic or question that drives the discussion; thus, keeping the discussion on track.

Synchronous chats

Synchronous chats (chats) allow the students to feel a since of community with one another and the teacher. Chats facilitate collaborative projects, enable students to get clarity about assignments, and supports discussion whether it is structured (i.e., focused on a specific topic) or unstructured (i.e., open forum with most topics being appropriate). Chats also require that everyone be online at the same time and can be text-based or voice or video enhanced. Because scheduling can be a problem for some students, it is best to schedule more than one time in which students can participate. As with threaded discussions, participation expectations (e.g., minimum number of postings, quality of postings, points associated with postings, identify person one is responding to) should be specified prior to the start of the chat and the chat should have a focus.

Debates/collaborative discussions, article discussions, expert speaker, and software reviews are a few activities that are suitable for chats. Each of these activities has a purpose, can be facilitated by either instructor or student, and can have a specified time frame. Kirby (1999) found that students were more comfortable with debates via chats after the second occurrence. When students submit their points and counterpoints, it can be confusing and discussion can appear chaotic since someone may be responding to a person's comment two or three comments above. Having several small group chats might help alleviate the chaotic nature of chats since fewer people are "chatting".

Planned face-to-face meetings

When logistics permit, planned face-to-face meetings can support and prompt more online discussions. During the meetings, everyone is able to put a face to the names of the individuals they will/have been communicating with online. Such name-to-face recognition nurtures community among the students. Cooper (2000) particularly encourages having an initial class meeting because it lets students meet the instructor and each other, ask questions, and learn about the course assignments, assessments, required materials, office hours and the online software. Subsequent face-to-face meetings can support the students in their efforts to complete assignments and/or get clarity about assignments as well as nurture the affective needs of the online students.

Lessons learned

Teaching online was a learning experience for me as well as for my students. I had assumed that my students had certain technology skills and had taken the online course orientation, which would familiarize them with the online software features. This was not an accurate assumption, and I learned that one should never assume anything when teaching online. Instead I should have had a face-to-face meeting to meet my students in person, demonstrate use of the online course, orient them to the course expectations, and as a consequence have a positive impact on our learning community. Fortunately, I did have a face-to-face meeting about a month into the semester and it created an atmosphere that was supportive and friendly for all of us. The new atmosphere was evident in the email communications that I received from the students. Prior to the face-to-face meeting some emails were cryptic and terse as well as offensive; after the face-to-face meeting the emails were clear, detailed and in most cases non-offensive. Having variety in the ways in which students could communicate was a definite plus as indicated by my positive course evaluations regarding online communication strategies. We used email, message boards for announcements, document sharing to peer review, focused threaded discussions, focused chats, and face-to-face meetings. In an online course it is important to communicate/discuss issues frequently. One means of communicating that I did not utilize in my class was group projects; however, in subsequent online courses I will. Collaborative projects increase students' motivation, support their need for familiarity with others, and support the learning community (Ekhaml, 2000).

Knowlton, Knowlton, & Davis (2000) suggest that to facilitate discussions for maximum learning the instructor should make students responsible for participation, model appropriate participation, synthesize students comments, and ask questions to encourage elaboration and clarification. I have learned that following this model will help me create an online learning environment that is friendly and supports students in achieving course goals. This is the type of online learning environment that I as an instructor want to create and maintain.

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Usability Evaluation of an Educational Electronic Performance Support System (E-EPSS): Support for Teacher Enhancing Performance in Schools (STEPS)

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Abstract

The concept of EPSS (Electronic Performance Support System) originated in business settings. Recently, there have been many attempts to apply the concept to schools: educational EPSSs (E-EPSSs) have become available on the Web. However, there is little evaluation research and few evaluation frameworks for these emergent E-EPSSs. The primary purpose of this article is to provide our design recommendations for how to improve the quality of E-EPSSs in general, based upon the evaluation of one specific E-EPSS, called STEPS (Support for Teacher Enhancing Performance in Schools). To achieve this purpose, the article first reviews E-EPSSs in terms of teachers' professional development and discusses their encompassing trends, needs, and definitions. Secondly, it presents an evaluation case of STEPS. An evaluation perspective called "perception-oriented usability evaluation" drives the evaluation. Lastly, it lists recommendations for improving STEPS as well as E-EPSSs in general based on our STEPS evaluation results and literature review.

Introduction

An exponential increase in information requires teachers to continuously develop their professional skills. As a response to this requirement, many researchers have proposed creating an EPSS (Electronic Performance Support System) to support instructional design activities, which is one of the main tasks of the teachers, through job-embedded learning (Reigeluth, 1999; Gustafson, 1993), and to promote training in education (Scales, 1994). EPSS has also been acknowledged as a system that can assist the school reform movement rather than a mere tool that may exert its influence in only a piecemeal way (Northrup & Pilcher, 1998; Scale, 1994). Applying an EPSS systemically not only can alleviate instructional and administrative burdens by supporting teacher performance, but also can provide teachers with job-embedded training opportunities. Using an EPSS, teachers can receive training within their teaching context. They don't necessarily need to leave their classrooms and school environment to improve their professional skills.

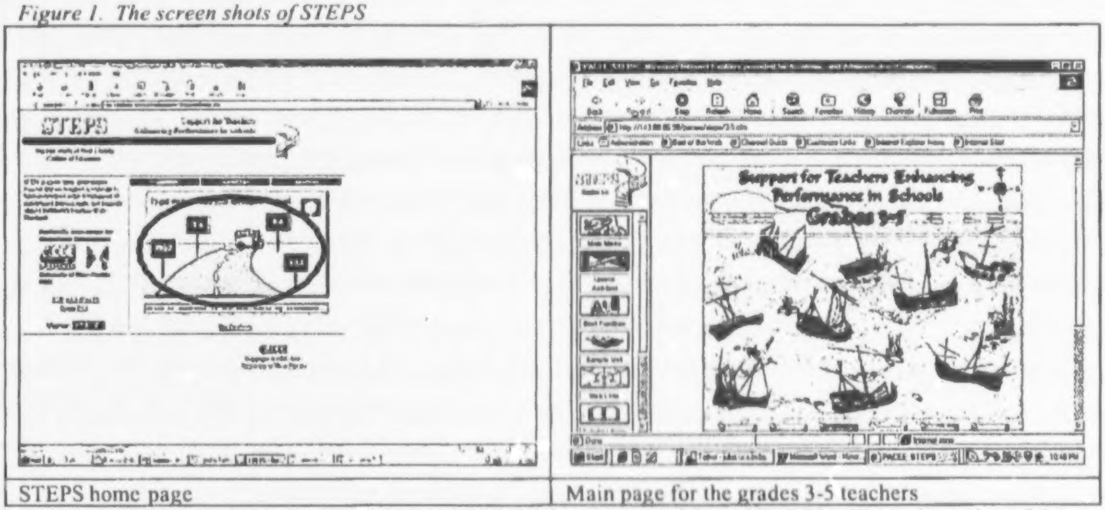
The concept of EPSS originated in business settings; however, recently, there have been many attempts to apply the concept to schools (Barker & Benerji, 1995; Northrup & Pilcher, 1998), and some educational EPSSs (E-EPSSs) have become available on the Web. However, there is little evaluation research and correspondingly few evaluation frameworks for these emergent E-EPSSs. In response to this scarcity of evaluation research, this article describes an evaluation study on one E-EPSS, called STEPS (Support for Teacher Enhancing Performance in Schools.) The article is composed of the following sections:

- Overview of the general features of a selected E-EPSS, STEPS.
- Review of E-EPSS as embedded in teacher professional development and its encompassing trends, needs, and definitions.
- Description of evaluation methodology.
- Results of the STEPS evaluation.
- Recommendations for the improvement of STEPS and the design of E-EPSS in general.

STEPS as an Evaluand

STEPS (Support for Teacher Enhancing Performance in Schools) is an EPSS designed specifically to help pre-service and practicing pre-K-12 teachers develop instructional lessons, units, and curricula aligned to Florida's Sunshine State Standards. According to Northrup and Pilcher (1998), the purpose of STEPS is to support school reform and sustain accountability of the integrated curriculum that utilizes technology, alternative assessment, and diverse learning environments and its conceptual frameworks include flexibility, learning by doing, and a user-designed structure.

Figure 1. The screen shots of STEPS



STEPS home page | Main page for the grades 3-5 teachers

STEPS is available through the World Wide Web or as a standalone CD-ROM. The web version of the EPSS was selected for this study. The first picture above is the screen shot of the home page of STEPS. It consists of four menus broken down by the grade level: PK-2, 3-5, 6-8, and 9-12. If the user clicks the signpost marked 3-5, then the main page for the grades 3-5 teachers, which is depicted in the second picture, opens. The main page of grades 3-5 consists of two groups of menus: the left-hand-side frame contains links to the Main Menu, which includes Lesson Architect, Tutorial Library, Best Practices, Sample Unit, Web Links, State Standards, Florida Information Resources Network (FIRN), and Florida Department of Education (FDE), and the right-hand-side frame includes links to the same menus in the left-hand frame. The main page for each grade group has the same menu structure.

The main six components of STEPS are Lesson Architect, Tutorial Library, Best Practices, Sample Unit, Web Links, and Coach. Lesson Architect is the main component of STEPS. It guides teachers through the processes of instructional design and curriculum planning. It uses Gagne's Events of Instruction (1992) and Dick and Carey's Systematic Instructional Design Models (1996) as theoretical foundations of instructional design, and various curriculum approaches such as webbing and threaded curriculum (Northrup & Pilcher, 1998).

Tutorial Library is a collection of about forty instructional tutorials. The tutorials follow the four premises of the STEPS curriculum: integrated curriculum, integrated technology, alternative assessment, and diverse learning environment (Northrup & Pilcher, 1998). Some tutorials are linked from the Lesson Architect so that users can get tutorials while they are planning lessons using the Lesson Architect. This function demonstrates one of the main advantages of EPSS--just-in-time support to the users.

Best Practices provide a forum for sharing successful classroom activities that were developed and tested by teachers in their real classrooms. In addition to keyword searches, users can search activities by Sunshine State Standard item or by theme. They can also browse by subject areas. This provides instructional strategies and tactics for designing classroom activities.

Sample Units provide sample curriculum units created by teachers of the same grade level. Grades 3-5 sample units, for example, center around an archaeological theme and provide 10-day model curriculum units. The model units utilize teachers' cross-curricular connections in Math, Science, Social Studies, and Language Arts and follow the benchmarks described in Florida's Sunshine State Standards. The teachers used Lesson Architect to create the units.

Web Links include over 400 web sites relevant to Math, Science, Social Studies, and Language Art identified in Florida's Sunshine State Standards. Each web site is linked to a brief description of the website and a list of applicable benchmarks.

Coach offers three levels of scaffolding: the "big picture" level, the "what do I do" level, and the "how do I do" level. It models the Knowledge Integration Environment created by the University of California, Berkeley (Bell, Davis, & Lynn, cited in Northrup & Pilcher, 1998). If users click "Ask Coach" or a corresponding graphic icon, a pop-up window appears and provides screen- and field-sensitive help such as descriptions of what the Lesson Architect is or how users can search information on relevant screens. Gery (1991) calls it an extrinsic support that is integrated with the software but not a primary function.

Literature Review

E-EPSS as a tool for teacher professional development

Traditional professional development programs for teachers have stressed knowledge acquisition through workshops and courses. These programs have had difficulties in providing sustained support needed for teachers to apply what they have learned in their classrooms. The performance-centered approach, however, provides such a sustained support by employing more practical knowledge dissemination. Teachers engage in performing processes through which they find problems, organize information, and infer a series of proper decision-making activities needed to solve their classroom problems. Specifically, the new professional development approach engages teachers in a series of concrete tasks of teaching, assessment, observation, and reflection. It is grounded in participant-driven inquiry, reflection, and experimentation. It supports collaboration and knowledge sharing among teachers, and focuses on communities of teaching practice rather than on individual teachers. It is intensive and sustained and supported by modeling, coaching, and collective problem-solving. Finally, it attempts to relate itself to other aspects of organizational change.

As a tool for the performance-centered approach and one of the viable alternatives for traditional professional development, an EPSS has been proposed for supporting the most critical activities of teachers, instructional design activities, i.e., curriculum development and lesson design. EPSS has been defined in various ways; however, there exist general agreements on the major goals of an EPSS. The goals are to: (1) provide "whatever is necessary to generate performance and learning at the moment of need," referred to as "just-in-time training systems" (Geber, 1991, p.34); (2) enable "day-one performance," the idea that novice users should be productive on the very first day that they start using a system (Gery, 1995); and (3) support higher levels of performance for the work being done today, while helping to build the knowledge infrastructure for work to be done in the future (Winslow & Bramer, 1994).

In the education field, there have been many electronic performance applications that meet or closely meet these common goals of EPSS although they are not always given the label "EPSS" (Collis & Verwijs, 1995). The applications include instructional material development tools, grade books, and behavioral management support systems. What are the differences between these electronic performance applications for teachers and E-EPSS? E-EPSS is an "integrated" support system that includes tools, expert systems, instructional activities, and databases that assist teachers "at the time and place they need the assistance." By supporting teacher practices at the moment of need, it helps teachers to improve their professional skills. The electronic performance applications, on the other hand, are single tools that support teachers in performing specific tasks. They are developed primarily as supplementary instructors, rather than as teacher professional development tools, that usually assist students' learning activities. In addition, they are based on traditional classroom practices that assume education is a delivery or transfer of knowledge (Chiero, 1996; Collis & Verwijs, 1995).

The recent advance of the Internet and other computer technology has created opportunities for teachers to use various Internet-based communication functions such as emails, distribution lists, and forums. Using these tools, teachers can now consult with experts in the areas where they have questions and share their knowledge and experiences with other teachers effectively and efficiently. Several examples of EPSSs that utilize such communication functions are currently available on the web. The STEPS web site available at http://143.88.86.98/pacee/steps/welcome.cfm (or at http://www.ibinder.uwf.edu/steps/welcom.cfm) is an EPSS designed specifically to help K-12 teachers to develop instructional lessons, units, and curricula. Another example, Pathways to School Improvement, available at http://www.ncrel.org/sdrs/pathwayg.htm, is designed primarily to assist high school teachers with their curriculum development.

E-EPSS Design

Many design guidelines and strategies for general EPSS can be applied to the design of E-EPSS. However, in designing E-EPSS, special attention must be paid to reflecting teachers' unique professional characteristics onto the system. This section discusses design suggestions adopted from the general EPSS design literature.

Components of E-EPSS.

Leighton (1997) synthesizes the ideas of Gery (1991, 1995) and Raybould (1990), and contends that an EPSS has four typical components: tools, an information base, an advisor, and learning experiences. Similarly, Carr (1992) explains that an EPSS can play the roles of a librarian, an advisor, and an instructor. Even though researchers name components of E-EPSS differently, their classifications have commonalties. Typically, an E-EPSS is composed of tools, a database, an expert system, and instructions (Gery, 1991; Raybould, 1990). The following list summarizes functions and examples of each component:

- Tools: Tools usually embody recommended procedures or best practices that should be employed by the user (Reeves, 1995). Examples of tools include word processing, spreadsheets, templates, and forms.
- Database: A dynamic EPSS includes an infobase and users supply much of its content. The shared base of user experiences grows over time, making the infobase increasingly valuable to organizations (Laffey, 1995). An infobase may contain on-line documents, reference material, case history data, etc.
- Expert system: An expert system usually provides two distinct types of support: proactive support and reactive support. Proactive support is usually delivered through a coach that provides assistance in setting goals and monitoring task completion. Reactive support is delivered through context-sensitive on-line help that assists users when they have reached an impasse and cannot proceed without overcoming a problem in using the software.
- Instructions: Instructions typically include Computer-Based Training (CBT), but not in a traditional form of CBT. Traditional CBT might employ a sequential approach in providing a four-hour course on instructional design process. Learning experiences within an EPSS, however, must be organized into capsules that contain five to fifteen minutes of instruction. The capsules typically deal with specific topics that can be accessed while tasks are being performed. Examples of instructions include multimedia, CBT, tutorials, simulations, and scenarios.

Depending on the scope and nature of an EPSS and technological platform, an EPSS is made up of a combination of at least one or more of these four components.

Interface Design of E-EPSS.

User interface is the single most important element of a successful electronic performance support system (Gery, 1995; Cole, Fisher & Saltzman, 1997). It is important to design the interface of an E-EPSS in a way that will support teachers' performance (Law, Okey, & Carter, 1995). To do so, designers need to consider teachers' mental models about teaching (i.e., what teachers think about instruction), workflow, and daily activities. The interface that follows teachers' natural workflow using screen metaphors that are familiar to them, facilitates understanding of the functions of an EPSS and accordingly reduces time needed for training. Hansen and Perry (1993) argue that long-term success of a system depends on teachers' degree of comfort and confidence in using a system.

As ways to capture teachers' mental models, Law et al. (1995) suggest the case-based reasoning approach through which one can analyze complex problems. They also recommend conducting a task analysis to determine what task components a product should include and how each component contributes to the overall product. To identify necessary components to be included, it is necessary to analyze the actual daily-based tasks, the performance of these tasks, and the elements that can alter each task (Moore, 1998). The analysis techniques of EPSS task analysis are similar to those of ISD (Witt & Wager, 1994). They include interviews, observations, questionnaires, and small-group discussions. EPSS task analysis, however, requires collecting data from both experts and novices, especially the data on their cognitive work processes, unique professional demands, and job-specific situations (Villachica & Stone, 1999; Stevens & Stevens, 1995). In other words, the components and content of an EPSS for teachers need to reflect teachers' unique workload in different types of schools – kindergarten, elementary school, and secondary school. Orey, Moore, Hardy, and Serrano (1997) report that middle school teachers spend an average of 31.6 minutes per day preparing resources and 49.4 minutes per day planning lessons. Depending on types of school categories of teachers' workloads and proportion of time, time breakdown is somewhat different. However, they are similar in that deskwork (i.e., grading) consumes a large portion of the teachers' office time.

The structure of an EPSS should be easy to use, flexible, and tailored for end-users having different needs and different expertise (Hansen & Perry, 1993; Remmers, 1998). A solution to accommodate different levels of competency of teachers is not to make all information directly visible, but to make it accessible, for instance by search tools that enable end users to find precisely the information they need (Sherry & Wilson, cited in Remmers, 1998). The structure of an EPSS must be customizable for the needs of different districts, schools, and teachers. In addition, cognitive loads and relational maps can be considered in design.

Raybould (cited in Gery, 1991) suggests six effective screen structures for different information maps: single frame, tree, network, linear format, rule, and animation. The Yale Style Manual (1999) introduces structures of Web-based EPSS that include sequence, grid, hierarchy, web structure, and empirical structure. Since each structure has its own strengths and needs, the developer can choose the system which best matches the prospective users' characteristics. For example, empirical structure is an effective way to organize a less-abstract view of the content when the users are novices in the field (Remmers, 1998).

Carroll's (1998) study on text interface led to the design of minimal manuals that drastically cut verbiage, encourage active involvement with hands on experiences as soon as possible, and promote guided exploration of system features. According to Paivio (1990, 1991), clear texts or images only are better sometimes than unclear texts with images and vice versa. To employ graphics in the design of EPSS, it is necessary to understand how graphics and other media (e.g., texts, audio, and videos) are cognitively processed and affect learning. The dual coding theory by Paivio (1990, 1991) describes how graphics become associated with texts in space and time. It also describes ways to organize materials according to the students' previous experiences.

Lastly, an action-oriented interface should anchor tools in the corresponding task domains and support error recognition and recovery in addition to the users' performance.

Usability Evaluation

Amidst the rise of the user-centered design principle, many system design institutions have realized the importance of usability evaluation and are practicing it as an ongoing system design and development process.

The formal definition of usability written by International Standards Organization (ISO, 9241-11) is "the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in a particular environment" (Bevan & Macleod, 1994, p.135). Bevan and Macleod explain that this definition characterizes usability as a "quality of use that can be measured as the outcome of interaction in a context" (p.135). What they mean by this is that the overall system context is composed of users, their goals (or tasks), and the physical and organizational environment, as well as the system itself. The quality of use is indicated by the degree of effectiveness, efficiency, and satisfaction as experienced in the result of the interaction among the four system components. The first two usability indicators, effectiveness and efficiency, are usually assessed by collecting behavioral performance measures in regard to learnability, efficiency, productivity, memorability, and number of errors (Nielsen, 1993). Satisfaction, on the other hand, is usually assessed by examining users' perceptions about the system.

Perceptions affect every aspect of the system, including usability. It is not rare to hear from users that they think a certain system is usable when they actually failed to perform tasks using the system. The reverse is often heard, too. This discrepancy between actual performance and perceptions has not been often researched in the field of usability evaluation. Traditionally, usability studies tended to collect only performance measures and determine a system's overall usability based on them. Even worse, they tended to disregard users' perceptions as invalid usability data.

Studies such as those by Bailey (1995), Tractinsky (1997), and Morris and Dillon (1997), however, began to address the discrepancy between performance and perceptions and to emphasize the importance of assessing perceptions. Since this kind of study is relatively new to the usability field, there is no standardized term to refer to the concept of perceptions. Words such as "preference" (Bailey 1995), "apparent usability" (Tractinsky, 1997), and "impression" (Morris & Dillon, 1997) are used interchangeably with "perceptions." According to Tractinsky (1997), people formulate preferences for one system over the other on the basis of their vague beliefs about which interface would provide the fastest performance or apparent usability that they perceive from the aesthetics of the system. The preferred system, however, does not always result in better user performance or actual usability. In their study on Netscape, Morris and Dillon (1997) conclude that users' initial perceptions of Netscape's usefulness and ease of use significantly influence their attitude toward using Netscape as well as their intention to use it. The implication of these studies is that we need to treat performance and perceptions separately. They also tell us that we should examine users' perceptions of the system's usability as well as their behavioral performance while using the system, to measure overall usability accurately.

Evaluation Methodology

Perception-Based Usability Evaluation

In this study, we used a perception-based usability evaluation method. An EPSS like STEPS was a relatively new idea to the education community, so we were interested in investigating whether target users of STEPS liked the system and perceived it to be usable. In addition, STEPS was still under construction at the time of the evaluation so collecting performance data at that stage did not seem to be meaningful.

This evaluation elicited participants' perceptions of three aspects of the STEPS web site: usability of the six main menus, existence of necessary EPSS components, and effectiveness of nine main menu icons. The STEPS web site consisted of nine main menus and six of them were primary components of the site. The six menus included Main Menu, Lesson Architect, Best Practice, Sample Unit, Web Links, and Tutorial Library. The matter of our primary concern was to evaluate whether the participants perceived the six menus to be effective, efficient, and satisfactory (i.e., usable.) In addition, we were interested in assessing whether the participants perceived that STEPS contained all the necessary features of an EPSS. As described in the literature review section, an EPSS typically contains four basic components: tools, database, expert system, and instructions. Lastly, we wanted to evaluate the effectiveness of icons associated with the nine main menus. On the main page, each main menu was represented through the combination of an icon and a textual link underneath. Our concern regarded whether or not the icons matched the textual links, representing the content of their corresponding pages well.

Data Collection Methods

Evaluation instruments included a usability questionnaire, a components questionnaire, a matching worksheet, observations, and structured interviews. The usability questionnaire (See Appendix A) aimed to measure the participants' perceptions of the usability of the six main menus. It consisted of yes-no answer items such as, "Are the page contents useful for intended users?" "Are the navigation icons or texts consistent?" and "Do you like using this system?" We used one questionnaire for each of the six main menus. The components questionnaire aimed to measure participants' perceptions of whether the STEPS website contained all the necessary EPSS components or not (See Appendix B). It consisted of questions like, "Does this EPSS have tools (e.g., templates, forms, word processor, spreadsheets) for facilitating teacher performance?" The matching worksheet (See Appendix C) assessed whether participants could match the main menu graphics with textual links correctly. We provided participants with a list of icons and texts and asked them to match corresponding icon and text. While the participants were exploring the site and responding to the questionnaires and the matching worksheet, observations were made to collect participants' reactions such as expressions of their frustration. The structured interviews (See Appendix D) at the end of the evaluation aimed to triangulate data from the questionnaires and observations.

To ensure the trustworthiness of the evaluation, we employed triangulation and member-checking procedures. This evaluation used three kinds of triangulation techniques: (1) data triangulation through the use of multiple data sources (e.g., questionnaires, observations, and interviews), (2) participant triangulation by asking individuals with diverse backgrounds to evaluate the website (e.g., elementary school teachers, instructional designers, and professors), and (3) method triangulation through the use of various data collection methods (e.g., questionnaires, observations, matching worksheets, and interviews. After analyzing observation and interview data, we summarized the participants' opinions and then asked the participants to review the summaries. The aim was to ensure that the data analysis results matched their original opinion.

Participants

Five participants engaged in the evaluation. Virzi (1992) conducted experiments regarding sample size for usability studies and concluded that observing four or five participants will allow a practitioner to discover 80% of a product's usability problems and observing additional participants will reveal increasingly fewer new usability problems. In addition, it is well known in the qualitative case study literature that there is a certain point after which discovery of new findings reaches saturation.

The target users of the STEPS website were K-12 teachers. Therefore, we invited people who had teaching backgrounds to participate; three of them have taught in K-12 settings and two have worked as teacher educators. We also invited people who had expertise in design and development of computer-assisted instructional systems, in addition to teaching experience. The purpose was to gather expert opinion on the design of the website. Appendix E summarizes profiles of the participants.

Evaluation Procedures

The evaluation took place in the most typical computing environment of each participant. Some participants did computing at home and others worked at the computer labs provided by their university. All participants used LAN Internet connection provided by the university. They used an IBM compatible PC or a notebook that had 24 RAM or more memory, Pentium 133 or faster processor, and 12- or 14-inch monitors.

At the beginning of the evaluation, the participants filled out a Demographic Information questionnaire (See Appendix F.) Then they were given instructions about how to conduct the evaluation. They were instructed to express any criticism frankly, use a think-aloud technique, and feel free to ask any questions about the evaluation procedures. It was particularly emphasized that if they were having difficulties in using the website it was not their fault but the fault of the website's ineffective design. When the participants felt comfortable about beginning the evaluation, we opened up the home page of the STEPS website and introduced the site's general purpose. Then, the participants were given six usability questionnaires, a components questionnaire, and a matching worksheet. They were requested to complete the questionnaires and the matching worksheet while exploring the site. Different participants looked at different levels of instruction since the entire STEPS website was too big for one person to explore in a given period of time. However, the evaluation criteria and scope were the same for all participants. Participant A explored the K3-5 level, participant B the K6-8, participant C the K9-12, participant D the K3-5, and participant E the K3-5. The participants thought out loud while exploring the site and we took notes of their comments. We sometimes asked probing questions if they did not verbalize problems voluntarily. When they finished all the questionnaires and the worksheet, a structured interview was conducted.

Evaluation Results

Results were derived from three evaluations: 1) evaluation of the six main menus' usability using questionnaires, observations, and interviews; 2) evaluation of the EPSS components using a questionnaire; and 3) evaluation of the match between icons and texts using a matching worksheet.

Usability of six main menus

The usability questionnaires asked for participants' perception regarding each menu's effectiveness, efficiency, and appeal. Table 1 summarizes percentages of positive (i.e., yes) responses.

Table 1. Percentage of positive responses in six usability questionnaires

	Best Practice	Sample Unit	Web Links	Tutorial Library	Lesson Architect	Main Menu
Effectiveness						
Are the page contents useful for intended users?	100	100	80	60	20	0
Do you believe this site can facilitate teacher performance?	100	80	60	60	40	0
Mean	100	90	70	60	30	0
Efficiency						
Are the navigation icons or texts consistent?	80	60	0	0	20	0
Is it easy to navigate back and forth?	80	80	0	100	0	0
Is the screen design user-friendly? (e.g., letter size, color, graphics, etc.)	80	60	20	20	20	0
Is the information concise?	80	40	40	20	20	20
Are the sentences easy to understand?	80	100	100	100	100	20
Mean	80	60	35	48	32	8
Appeal						
Are you interested in this EPSS?	100	60	60	60	20	0
Do you like using this system?	100	60	60	60	40	0
Mean	100	60	60	60	30	0

In the effectiveness evaluation, participants responded most positively to Best Practice. Sample Unit was second at 90%, followed by Web Links, Tutorial Library, Lesson Architect, and Main Menu. In the efficiency test, Best Practice was rated to be the most positive followed by Sample Unit, Tutorial Library, Web Links, and Lesson Architect, with Main Menu receiving the least positive evaluation. In the appeal evaluation, Best Practice received the most positive responses, followed by Sample Unit, Web Links, Tutorial, Lesson Architect, and Main Menu.

Overall, the participants responded to the three criteria in a similar pattern. They favored Best Practice the most and Main Menu the least for all three criteria.

The results from the interviews were congruent with those of the questionnaires. Most participants made positive comments on Best Practice, including "menus organized by subject makes it easy to grasp the content," "it provides examples of specific objectives," "table structure of the menu makes it easy to navigate," "color change gives the indications of where I am," and "it provides concise information with graphics and animations." For Sample Unit, participants made both positive and negative comments. On the other hand, participants responded more negatively to Main Menu and Lesson Architect. For Main Menu, in particular, five participants expressed similar concerns such as "the location of buttons is inconsistent so navigation is not easy," and "after clicking, there is no consistency in screen display." For Lesson Architect, participants responded negatively, making comments such as, "it's hard to know the function of icon-only buttons," "there is no direction after clicking," "too much scrolling to do," and "data are not organized so it's not easy to find needed information."

EPSS components

Most participants identified STEPS as a system that contained database and tool components more than instruction or expert system components. All participants agreed that STEPS contained database, 80% agreed it contained tools, 40% instruction, and 20% expert system. They pointed out that Lesson Architect was a template embedded with word processing functions. They commented that, using Lesson Architect, a teacher could develop and save instructional designs and curriculum plans with the help of instructional theories such as Gange's Event of Instruction. Web Links included links to numerous web sites. Best Practice was a database of effective classroom activities.

Although participants did not recognize it clearly, STEPS did include expert system and instruction components. Ask Coach and Tutorial Library were representations of the components. Ask Coach provided field-sensitive help in a pop-up window; however, most participants stated that the help was not informative or useful for actual instructional activities. The fact that Ask Coach was still under construction might have been the cause of this response. Also, most users thought that it is very limited in that it only provides fixed explanations and cannot make a relational query within the Coach or support customized help depending on users' level of competence. As for the Tutorial Library, participants responded that the information was not useful for specific design activities.

Match between icon and text

None of the participants matched more than four of the nine pairs. Evaluator A matched 3 pairs, evaluator B matched 2, Evaluator C, 1, Evaluator D, 4, and Evaluator E, 3. The difficulties in matching icons with texts were caused mainly by the inadequacy of icons in portraying corresponding textual information. In addition, the way line spacing was used made it difficult for participants to know which icon corresponded with which text.

Overall comments

The participants agreed unanimously that an EPSS like STEPS was a powerful tool for effective instruction. However, they said that STEPS should go beyond being an electronic book. They commented that it should facilitate interaction between teachers and provide guidelines, not just information. They thought teachers would be able to enhance their performance with the help of such interaction and guidelines.

Recommendations for Designing an E-EPSS Effectively

Based upon our evaluation results and literature reviews on E-EPSS design, we recommend the following heuristics for effective E-EPSS design.

Design an interface that supports teacher performance

Participants did not think that Main Menu and Lesson Architect facilitated teacher performance. This response is critical in the case of Lesson Architect especially, because Lesson Architect is supposed to facilitate teacher performance by helping teachers to build lesson plans. Laffey (1995) asserts that current models of EPSSs provide the kinds of resources needed but do not support the processes by which these resources are used or customized for the work environment. Instead of seeing an EPSS as merely a vehicle for delivering information, we need to see it as a re-conceptualization of the work environment.

Provide context specific information

Participants thought STEPS lacked expert system functions and particularly context - or subject-specific guidelines. Evaluator B, for example, responded, "STEPS looks like a teacher guidebook but its information is too general, not subject-specific." She recommended that the Language Arts section should contain more specific information to be useful in actual instructional design activities.

The process of determining the content of an E-EPSS should involve a thorough examination of related literature and consultation with subject matter experts, teachers, and teacher educators. It should also include identification of teachers' daily activities such as lesson planning and instruction design. Once the activities are identified, the designer needs to specify possible questions teachers could ask at each stage of the activity, and provide necessary supports that will answer the questions. This kind of support must be updated and expanded when necessary.

Provide structured navigational schemes

The evaluation results show that people like structured navigational scheme such as menus organized by subject in a table format. To provide a structured navigational scheme, it is important to build a "bird's-eye view" into the design. Users should be informed about where they are now and where they should go next. In STEPS, the hierarchy and relationships among different levels (corporation level, unit level, and lesson level) are not indicated clearly, resulting in confusion in navigation.

The Object Action Interface (OAI) model by Shneiderman (1998) is useful for designing a structured interface. It guides system designers to view interfaces in terms of the tasks that the interfaces will carry out. By matching interfaces with tasks, designers can produce task-oriented and structured interface designs.

Consider the level of students the users teach

Participants mentioned that content in STEPS should consider grade levels. If the content is for elementary teachers, for example, it should reflect perspectives and difficulty levels appropriate for elementary students. In this way, the teachers will be able more easily to relate what they get through STEPS to their students' learning activities. Rummers (1998) contends that the structure of an EPSS should be easy to use, flexible, and tailored for end-users with different needs and expertise.

Provide interactive screen designs

Participants made comments such as, "it's more like a technical report," "texts are not easy to read," "the content seems like texts from a book," and "I need to do too much scrolling and get lost often." These comments tell us that STEPS could be perceived as an electronic page-turner. To prevent this perception, STEPS needs to incorporate action-oriented design approaches such as anchoring tools in the task domain and supporting error recognition and recovery, and user performance.

Limitation of study

Although we referred to a published article by the STEPS developers, Northrup and Pilcher (1998), we did not have access to enough of the developers' opinions regarding their intentions about STEPS development and the purpose of the program. In addition, we did not have any information about their development processes such as difficulties in the processes and timelines of their development and implementation.

The evaluation materials that we developed for this study are the results of our research on usability and educational evaluation studies. Although we hope the materials helped us measure participants' perceptions accurately, we think the materials need to be subjected to quality examination such as reliability and validity tests.

It should be noted that the questionnaires measured participants' subjective perceptions of the program. Objective performance measures such as time taken to finish certain tasks or error rate were not collected in this study. A future evaluation study that collects performance data will provide us with a richer picture of the program's usability and educational value.

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Integrating Educational Technology into Field Experiences and Teacher Education Curriculum-A Systemic Approach

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Abstract

Field experience is a crucial stage for prospective teachers. However, evidence shows that there are only twenty percent of teachers in the nation feel well prepared to integrate educational technology into classroom instruction (1999, Year 2 StaR Report). As a result, the prospective teachers may not observe classroom teachers integrating educational technology during field experiences. This presents a severe deficiency in the teacher preparation process. This project is about systemically integrating educational technology into field experience and the Teacher Preparation curriculum. Through consultation and training, cooperating teachers work with prospective teachers to implement educational technology into field experiences, while faculty members in the Teacher Preparation Program and the Arts and Sciences Departments set role models in the methods courses and regular curriculum. Systemic growth and collaboration will sustain in the participating schools and the teacher education institution.

Need for the Project

Field experience and student teaching are two crucial stages for prospective teachers before they become regular classroom teachers. They take methods courses in the teacher education program that prepare them in concepts regarding how a classroom is constructed and how learning and teaching are developed in the classroom context. It is not until the field experience that the prospective teachers often realize the real work of teaching from a teacher's point of view. They observe and depend on the cooperating teachers to provide the models and to demonstrate how learning and teaching can take place effectively in the classroom. Based on CEO Forum Reports (1999, Year 2 StaR Report), only 20 percent of teachers in the nation feel well prepared to integrate educational technology into classroom instruction. This means that, when prospective teachers go into the field, the chances are that they may not observe classroom teachers integrating educational technology, depending on whether or not their cooperating teachers are among that 20 percent of teachers. Given the national awareness of how technology should be integrated as a powerful learning and instructional tool in the classroom (NCATE, ISTE Standards), this statistic reminds us that there is a severe deficiency in teacher preparation programs. No matter what kind of technology training and method courses we equip our prospective teachers with in the teacher preparation curriculum, they may or may not be able to see how educational technology is being used in real classrooms during field experience.

The Teacher Education Program at a reputable private university located in north central Ohio requires perspective teacher to take at least two courses in educational technology. The course content includes skills in using different traditional and non-traditional technology, theories about why and how educational technology should be integrated to enhance learning and instruction, and examples of integration. However, if the field experience does not ensure the perspective teacher an appropriate context, the training and knowledge the perspective teacher received from the program cannot be validated and reinforced in real classrooms.

The Teacher Education Program and the College of Education at this university are among the largest in the state of Ohio. The university sends out over 500 students for field experiences every semester and works with 23 school districts (103 school buildings) including over 350 cooperating teachers. Based on the survey delivered to these cooperating teachers who work with this university, there are only 25 percent of the teachers who feel confident in integrating technology in the regular curriculum. With these figures in mind, we wonder how many of our children in the classrooms missed out on the opportunities to use technology as a powerful learning tool and are being under-prepared for the digital era.

Another area that presents a problem is the low percentage of educational technology integration in courses that prospective teachers take from the Arts and Science Department (30%) and the Teacher Education Program (35%) at this university. Not all faculty members who teach these courses have the knowledge and skills to model the integration of technology into curriculum as inquiry and instructional tools. As a result, the prospective teachers face double jeopardy. Not only can't they see much modeling from their cooperating teachers during field experiences, neither do they see much modeling within their teacher preparation curriculum with the exception of the two educational technology courses.

To correct the deficiency of the teacher preparation process, a systemic approach is in order. This approach entails a partnership among the stakeholders including the Teacher Education Program, institutions that host the program, faculty members in the Teacher Education Program and the Arts and Science Department, public schools administrators, classroom teachers, prospective teachers, and community members. With the understanding that the partners involved in this project will have far more impact than the initial scope of this project, the next section will explain the design by which this partnership improves and eventually resolves the aforementioned problems.

Design of the Project

A. Goal and Expected Outcomes

The goal of this project is to systemically improve the field experiences of the Teacher Education Program and the degree to which cooperating public schools and the university faculty members integrate educational technology (ET) into regular curriculum. The expected outcomes include but are not limited to the following:

- Increased degree of educational technology integration in field experiences for the prospective teachers at the university.
- Increased confidence of prospective teachers in integrating educational technology in the classroom settings.
- Increased skills and knowledge of prospective teachers in integrating educational technology in the classroom settings.
- Increased degree of educational technology integration in participating public schools.
- Increased degree of educational technology integration in the Teacher Education Program and Arts and Science Department in the university.
- Increased confidence levels for participating professors in the use and integration of educational technology in the content courses.
- Increased confidence levels for participating cooperating teachers to sustain the interest and the skill of educational technology integration.
- Increased collaboration among teachers and prospective teachers in educational technology integration.
- A consortium Web site will be built for this project so that all participants can use the collective information (i.e., lesson plans, integration ideas, published student works, etc) and collaborate their efforts. This Web site will be designed in ways that can accommodate people with disabilities.
- A documentary videotape will be made to share the successful experiences and preliminary model with other universities and k-12 schools.

B. Description of the Project Design

This partnership will be developed in the following four stages -preparation: commitment of partners; assessment and training; adaptation; summative evaluation and diffusion. Formative evaluations will be conducted in each stage to evaluate the effectiveness of the process. A consortium Web site will be built to contain the information of this project. A videotape will be produced documenting the entire process to be used in the diffusion stage of the project.

Stage 1: Preparation-Commitment of Partners
Time Frame: Pre-Project Time

In the first stage of the partnership, each partner will need to commit to the shared vision and provide the necessary resource (i.e., service, time, money, equipment, etc) to facilitate this partnership. The shared vision is to systemically improve the quality of field experience of the Teacher Education Program, the quality of teacher preparation curriculum, and the competency of classroom teachers in the area of educational technology integration, in turn to produce competent teachers and richer educational experience in the classrooms. The partners in this project include the Teacher Education Program at the university; the Educational Technology Program in the university; 6 school districts; faculty members in the Teacher Education program; faculty members in the Educational Technology program; faculty members in the Arts and Science Department who teach methods courses to prospective teachers; cooperating classroom teachers from 6 school districts; and prospective teachers who are enrolled in the teacher education program at the university.

Examples of commitment include but are not limited to the following:

1. Participating school districts will raise 3% of the budget in the area of educational technology.
2. Participating school districts have to continue to support the existing in-service training in the area of technology integration.
3. Public schools administrators will commit to obtaining video conferencing facilities (i.e., cable TV, Polycom unit, or Satellite dish) for cooperating teachers to receive consultation at their school sites.
4. Educational technology faculty members in the Teacher Education Program will be given released time and incentives to offer training to faculty members in the Teacher Education Program and methods teachers in Arts and Science Department.
5. The university will have a video conferencing facility and video capturing and editing equipment for the Teacher Education Program since these are the areas that have not been covered in the curriculum due to the lack of facilities. In addition to necessary on-site consultation, educational technology faculty members and selected professionals will need this facility to deliver consultation to classroom teachers in different school districts.
6. Faculty members in the Teacher Education Program and faculty members in the Arts and Science Department who teach methods courses will commit to receive training or consultation in the area of educational technology integration.
7. Participating school teachers who are skilled in the area of educational technology are given incentives to coach peer teachers or to conduct in-service training
8. Although not as official members in this consortium, educational technology professionals from the Tri-County Computer Service Association (TCCSA) and Tri-River Educational Computing Association (TRECA) will be contracted to provide consultation to the cooperating teachers and prospective teachers either on-site or via video conferencing facilities regarding how to integrate educational technology during the field experience sessions.
9. Prospective teachers who have taken educational technology courses in the university will assist the cooperating teachers in needed technology skills while working with consultants to integrate educational technology into field experiences.
10. Classroom teachers who receive consultation as a result of this partnership will provide consultations to their peer teachers given limited incentives.

Stage II: Assessment and Training
Time Frame: First Project Year (June,1, 2001-May 31, 2002)

In the second stage, the focus of this project is to identify the areas where the faculty members in the Teacher Education Program and the Arts and Science faculty members who teach methods courses lack knowledge and skills, and provide training that is needed. The areas where cooperating classroom teachers need consultation from the trainers are also identified during this stage.

Based on the national standards (ISTE), the contents of training and consultation sessions for participating university faculty members, cooperating teachers, and prospective teachers would include but not be limited to the following:

- Basic concepts and skills of using computer systems
- Basic concepts and skills of using computer related peripherals, i.e., scanner, digital camera, projectors, etc)
- Using productivity tool (word processor, spreadsheet, database) effectively as teaching, learning, and management tools.

  Examples
  - Proficient use of word processor to produce document for specific purpose, such as newsletter, communication, and professional documents.
  - Power point presentation– Instructional tool (teacher), learning tool (students)
  - Spreadsheet application-inquiry project, grading sheets, etc.
  - Database-inquiry project, resource management, test bank, etc.

- Using Hypermedia tools such as Hyper Studio and KidPix as instructional and learning tools. Examples: tailored tutorial, drill and practice for specific topic & students; student created projects for specific topics under study.
- Using Internet applications for research, communication, instruction, learning, and management.

Examples:

- Advanced email communication and listserv
- Locate and utilize resource database
- Develop Web pages that include instructional element (tutorial, information), learning element (research project, collaborative learning projects), management element (class Web site, syllabus, and communication with students and parents).
- Be able to search useful Web sites and create annotated list of good software and useful sites to share with colleagues.
- Be able to provide description of criteria for selecting and evaluating educational software.
- Be able to provide a written guide and example of using Web sites and software for inquiry projects.
- Using existing assistive technology features for inclusion classrooms.
- Using video conferencing facilities to communicate and to collaborate.

A needs assessment will be conducted to identify the gap between the desired training outcomes and the current skill and knowledge of the participating university faculty members. After the needs are identified, the university faculty members need to commit to signing on for training sessions so that they can model the use of technology in the context of their subject matters.

The Educational technology faculty members in the university and selected professionals will provide training to the participating faculty members either on sites or via video conferencing. Similar needs assessment will be conducted for participating cooperating teachers. With the pre-existing in-service training that individual participating school offers, the trainers will consult and scaffold cooperating teachers and prospective teachers to integrate educational technology into field experience sessions. The classroom teachers will be informed of the schedule when the skill sessions will be provided for university faculty members. The cooperating teachers are welcomed to join the sessions via video conferencing facilities or on site where the facilities permit.

Knowing the cooperating teachers and prospective teachers have integrated educational technology into field experiences, faculty members who teach educational technology courses in Teacher Education Program will incorporate the field experience sessions into the courses using video conferencing facilities. With permission from the administrators and cooperating teachers, the field experiences sessions can also be videotaped and later shown as examples for prospective teachers. The prospective teachers who have not engaged in field experiences will have the opportunity to see what is done in the classroom context. This can provide an authentic, real world, and motivating experience for the prospective teachers to learn how to use and to integrate educational technology in the classroom settings.

Surveys will be conducted to examine the effectiveness of each training session and consultation process. The training sessions for university faculty members can be videotaped for review by participating faculty members and for evaluation purposes. All participating classroom teachers, prospective teachers, and faculty members will be requested to provide reflection papers on their progress in integrating educational technology with provided guidelines throughout the year. Prospective teachers will continue to apply what they have learned and observed from field experience to their student teaching. They can even apply the consultation skills observed from the trainers to consult with their colleagues in the future. In addition to the reflection papers, participating classroom teachers also have to provide records on the noticeable change in students' performance and motivation for learning or any noticeable changes in other aspects of learning. Integration lessons and curriculum examples are collected. The collected examples will be put onto the consortium Web sites so that all the participants in this project can collaborate and share the information and integration ideas. These experiences will also be shared and demonstrated in the showcase conference.

Surveys will be conducted to evaluate specific aspects of the overall progress. The progress results will be tallied, documented, and analyzed by professional evaluation analysts.

Stage III: Adaptation
Time Frame: Second Year (June, 1, 2002-May 31, 2003)

As a result of training sessions during the first year, more participating university faculty members are better prepared to model the integration of educational technology in different subject matters. Some of the faculty members can also assume leadership roles to offer training for their colleagues.

In the participating schools districts, some of the participating classroom teachers start to serve as consultants to their peers. Under the supervision and with the consultation of their trainers, these cooperating teachers can even conduct in-service training to their peer teachers. This process is to make these cooperating teachers feel confident in integrating educational technology into the classrooms and make public schools a natural place for collaboration and professional development.

The gap between prospective teachers and classroom teachers starts to diminish at this stage. A collaborative relationship is fully developed between prospective teachers and classroom teachers. Prospective teachers who go on to student teaching become proficient peers with their cooperating teachers. In the mean time, a new group of prospective teachers will work with the trained cooperating teachers and will have better field experiences since the cooperative teachers demonstrate the effective integration of educational technology into the classrooms. The TCCSA and TRECA professionals and educational technology faculty members will continue to consult a new group of cooperating teachers with a new group of prospective teachers to integrate technology into field experiences. The faculty members who teach educational technology courses in the Teacher Educational Program can incorporate the field experience session via video conferencing with the prospective teachers who have not yet engaged in field experiences. The cooperating classroom teachers can also serve as guest speakers in the courses to demonstrate and to motivate prospective teachers even before the prospective teachers start their field experiences.

Although the provision of training is still needed, half of the responsibility of the trainers shifts to consultation and scaffolding rather than conducting training to participating university faculty members. Participating public schools become more self-sufficient and continue to grow in the degrees of educational technology integration. More and more teachers are able to contribute to the collective growth of their schools in the area of technology integration. Less external training and consultation resources are needed for participating public schools.

Additional training areas are explored for participating university faculty members during this stage. The professional trainers and educational technology faculty members will provide new training topics depending on the new developments in educational technology and how the needs evolve.

Showcase conferences will be held annually. The participating university faculty members, cooperating teachers, and prospective teachers will share their experiences and progress in the conference. Evaluations of training sessions are conducted whenever training is offered. Throughout the year, all participating classroom teachers, prospective teachers and faculty members will submit progress reports and reflection papers based on provided guidelines. Educational technology integration lessons and curriculum examples are collected and put onto the consortium Web site. Classroom teachers continue to document the changes in students' performance and motivation for learning. Surveys will be conducted to evaluate specific aspects of the overall progress of this stage. The progress results will be tallied, documented, and analyzed by professional evaluation analysts.

Stage IV: Summative Evaluation and Diffusion
Time Frame: The third year (June, 1 2003-May 31, 2004)

While more and more faculty members and classroom teachers are being trained and become trainers, and prospective teachers continue to develop collaborative relationships with classroom teachers, the last stage of this project focuses on evaluating the project and diffusing the successful experiences of this project. The collected progress reports and reflection papers, classroom teachers' documentation on students' performance and motivation to learn, the evaluation of training sessions, the overall effectiveness and progress during each stage, and grant resource utilization are all systematically reviewed and tallied. Reports will be generated to illustrate the effects of this project. The Educational technology faculty members will offer a capstone course that focuses on evaluating the effectiveness of educational technology integration and will invite graduate students in educational technology to develop capstone experiences for the evaluation phase of this project.

The results of the project will be first shared with all partners in this project. As a whole, the partners will evaluate the effectiveness and efficiency of the project, the long-term benefits, and the future dissemination goals.

The results of this project will also be shared in major teacher educator conferences or educational technology oriented conferences such as ATE (Association for Teacher Educators), AECT (Association for Educational Communication and Technology), and NECC (National Educational Computing Conference). With the documentary videotape and consortium Web sites produced in this project, this project can serve as a model to help other universities and public schools systemically improve teacher preparation programs and produce more competent classroom teachers in the area of educational technology integration.

Conclusion

Enhancing the quality of teacher preparation programs in the area of educational technology integration is by no mean an easy task. It entails systemic approaches to adjust the conditions of all the stakeholders to make the effort fruitful. The design of this project is one of the many endeavors undertaken by many educators and practitioners. The author believes that with the continuous effort, we will see the difference in the quality of our future teachers who ensure our children to be well prepared for the 21st Century.

Student Technology Assistant Programs

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Introduction

Schools face significant challenges in implementing computing technology within their curriculum. Federal funding programs such as e-Rate are helping schools surmount the first obstacle – initial technology purchases. According to a recent article in *Electronic School*, the average school district now has 800 computers, or one for every 4.9 students (Kongshem, 2001). The National Center for Education Statistics reports that 98% of public schools are now connected to the Internet (Cattagni, 2001), and while this does not always mean individual classroom connections, it is nonetheless one of several strong indicators of the prevalence on technology in schools.. However, still remaining as formidable obstacles are the costs of maintaining this technology and providing training for its effective use. As Kongshem's *Electronic School* article points out, computers are no longer concentrated in computer labs. Increasingly, they are located in classrooms where technical support staff may have difficulty providing adequate support. Teachers are fast developing skills and strategies for integrating these classroom computers into the curriculum. As technology becomes a more powerful tool for delivering the curriculum, teachers are relying more and more on quick and reliable repair of their classroom computers.

In the business world, one full-time person has responsibility for maintaining 50-75 computers (Consortium for School Networking, 1999). In contrast, most school districts tend to provide one support person for every 500 computers. Typically in the business world one computer is used by a single user. But in the classroom, computers serve the needs, and suffer the abuses, of many users. It is no wonder that sometimes technology support in the schools falters.

And when technology support falters, the integrity of a school district's entire technology program is at risk. Teachers who have invested time to develop lesson plans using technology, especially those who are still newcomers, are less likely to continue to invest their energies if they cannot count on their computers to be up and running. When parents ask their children how computers are used in the classroom, or when parents visit the classroom, they may discern little or no technology use. These lapses may diminish the community support that is necessary for continuation or expansion of the district's technology program.

The purpose of this article is to describe how Student Technology Assistant (STA) programs can help schools, in particular rural school districts, solve some of these problems. Small rural school districts are less likely than large urban school districts to be able to purchase and implement the technology management solutions recommended for these new decentralized networks of computers. Instead, rural school districts like Plymouth (Wisconsin) School District are turning to creative programs where students help do the work: "It's not a formal program, but we recruit kids when they hang around and when we know they're interested. If a kid puts in a full class worth of time, we'll pay around five or six dollars an hour" (Kongshem, 2001). Sedgwick (Kansas) School District for several years has selected five top Computer Tech students to serve as Tech Apprentices, offering the students an elective credit for their participation. In an interview with HPR*TEC's *KidSpeak* webzine, one Tech Apprentice noted, "If they just come in and hire a bunch of people, the people they hire don't go to school here everyday. They don't know the teachers. With students doing it… the teachers know us" (Brown, 2000). While the Plymouth and Sedgwick programs are fairly informal, many of the STA programs highlighted here are quite formal. All of them work by providing students with opportunities to gain credit for technical experience, at the same time providing technical and sometimes instructional or community-related services to others. In exchange for providing these experiences, the schools receive technical support, training for their teachers, and good communication with and support from the community for their efforts. The increased visibility and "buy-in" also give a boost to the adoption and diffusion of technology throughout the school.

One danger in implementing an STA program is that the educational needs of the students may become lost in the shuffle of administering the program. Before turning to specific programs, we'll examine this danger more closely. Then we'll define a successful STA program, discuss first steps in establishing such a program, point out a few operational considerations, and finally take a look at six successful models.

Education First

At home, more and more school-aged children are gaining access to computers and the Internet. By August 2000, the percentage of homes with computers had risen to more than 50%. Household Internet access has also increased dramatically (NTIA, 2000). There is little doubt that computer access is becoming less of a problem while our students are coming into the classroom with more technical know-how each year.

Some headlines have called attention to the potential exploitation of these technology-savvy students as technology workers in their schools. Jamieson McKenzie, editor of the online education technology journal *From Now On*, draws similarities between some computer helpdesk tasks and mowing the school lawn or washing cafeteria dishes. "It's exploiting children," he says, "There are lots of jobs that need to be done, but we expect adults to do them" (Vail, 1999).

Similarly, some are concerned that students may have inappropriate access to data. A *Los Angeles Times* article reported that in 1997 members of a local California School Educators Association chapter filed a complaint with the Irvine School District because students had unsupervised access to "the most sensitive material we store: grades, personnel records, attendance, personal e-mail" (Huffstutter, 1998).

Advocates of STA programs note that several of the larger STA programs include carefully designed curricula that address ISTE's National Educational Technology Standards. Other programs incorporate coursework that leads to A+, Cisco, Microsoft, or Novell certification. Advocates stress that students should not be penalized for their technical knowledge. In the words of Dennis Harper, the director of Generation YES, "Schools must stop operating like factories, and start to work like modern companies. The kids are the ones in power because they have the knowledge. And if you can't trust your kids, you're in trouble" (Huffstutter, 1998). Michael Milone of *Technology and Learning Magazine* praises one STA program, SWAT, for its encouragement of students as stakeholders: "Students who participate in SWAT gain a sense that they are active participants in the education process and recognize that their contributions are valued, thus they develop a stronger sense of ownership of the process" (http://www.iit.edu/~swat/overview.html).

Perhaps the most often mentioned advantage of STA programs is that they give students marketable skills and real-world problem-solving experience. In the January 2001 cover story of *Electronic School*, "The New Networkers: The Path to Hot IT Jobs Begins in High School," Kevin Bushweller notes that according to recent industry projections "about 1.6 million new IT workers will be needed this year, but hiring managers predict that about 850,000 positions probably won't be filled by appropriately skilled workers."

To keep your program aligned with your school's educational goals, you may want to keep in mind the advice offered by Kathleen Vail in her article "Kids at Work: The Pros and Cons of Using Students as Technology Workers" (1999):

- Make sure the community knows what you're doing.
- Make sure the program has an educational element.
    - Offer class or internship credits
    - Allow students to work only during scheduled times
    - Balance a technology apprenticeship with apprenticeships in other careers
- Make sure the students are supervised and mentored.
- Keep the pressure off.
- Keep an eye on security.

What are STA Programs?

Students have helped maintain computers since computers first entered schools in the 1970s. However, the start of formal large-scale STA programs can be traced to 1989 when Mike Bookey, a parent of a middle-school student in Issaquah (Washington) School District, agreed to help his daughter's school with a computer problem. Issaquah is home to many families who work for Microsoft and other high-tech companies. Yet the schools were, according to Bookey, like "a tribe cut off from the outside world for so long that they didn't know about telephones, voice mail, computers, e-mail, television, Internet and other tools of the information age" (http://www.svi.org/connect96/Profiles/Issaquah.htm). With the help of concerned educators, the support of taxpayers, and the volunteer time of many high-tech community members, Bookey started the TIP program (Technology Information Project). At Liberty High School in Issaquah, a small group of TIP students began meeting after school to learn about different network operating systems and to build prototype networks. TIP students and other volunteers did the "heavy work" of installing and troubleshooting equipment within the school district. A formal curriculum based on the TIP students' experience and modeled after similar corporate programs was put into place in Issaquah in 1992 (http://www.Issaquah.wednet.edu/district/technology.htm). Issaquah's TIP program has since been replicated in other Washington districts, and many of the later STA programs drew inspiration from presentations which Issaquah students made around the country in the 1990s and through well-attended "open houses." TIP students worked as consultants for the State of Kentucky Department of Education in planning Kentucky's first STA conference in February 1995.

Issaquah, the community, is unlike most U.S. communities in its concentration of high-tech expertise and its taxpayer support of technology initiatives. In most of the programs discussed in this article, leadership for STA programs did not come from community members but instead from educators, and in some cases from the students themselves. For this article we've selected a range of programs, each with its own areas of emphasis. But in all of the cases discussed here, student technology assistants (STAs) are K-12 students who, under the leadership of their school, provide technological assistance to others. Usually, the assistance provided by such students is focused on instructional, technical or community-related activities. Students in such programs learn technology-related skills while providing a service to others. The work of STAs is often hailed as being beneficial for all involved.

Starting an STA Program

Given the relatively inexpensive start-up and maintenance costs of an STA program, many schools are looking to start their own program. The logical question, then, is how to proceed. The following sections detail some ideas for starting your own STA.

Determining What Kind of STA Program You Want

The first step is to determine what kind of STA program you want. The Educators' Technology Center of Indiana suggests that you begin by asking yourself who needs help and what kind of help are needed (http://etc.iupui.edu/pyop.html). Will your program focus solely on providing technical support to teachers and instructional computer equipment? This is one of the most common and cost-effective models for an STA program.

However, STA programs that address technical issues AND professional development can promote technology integration throughout the school and sometimes even save professional development costs. Such programs, however, require additional management and resources including, respectively, a coordinator for the program and monetary support from the school, district, and/or state. Such programs also do little to promote community awareness. Thus extra effort may be needed to publicize the good work the school is doing.

STA programs that combine all three types of service – technical service, professional development, and community projects – are generally the most beneficial (see Figure 1 for examples of the three types of service). The downside, of course, is that these programs require a significant commitment of resources in terms of management and coordination. Somebody has to serve as liaison to the community, evaluate possible projects, assign people to projects, monitor progress, and provide publicity in addition to generating the technical and professional development projects done in-house. There is no reason a school cannot begin with one type of program and expand as the school's needs and resources grow.

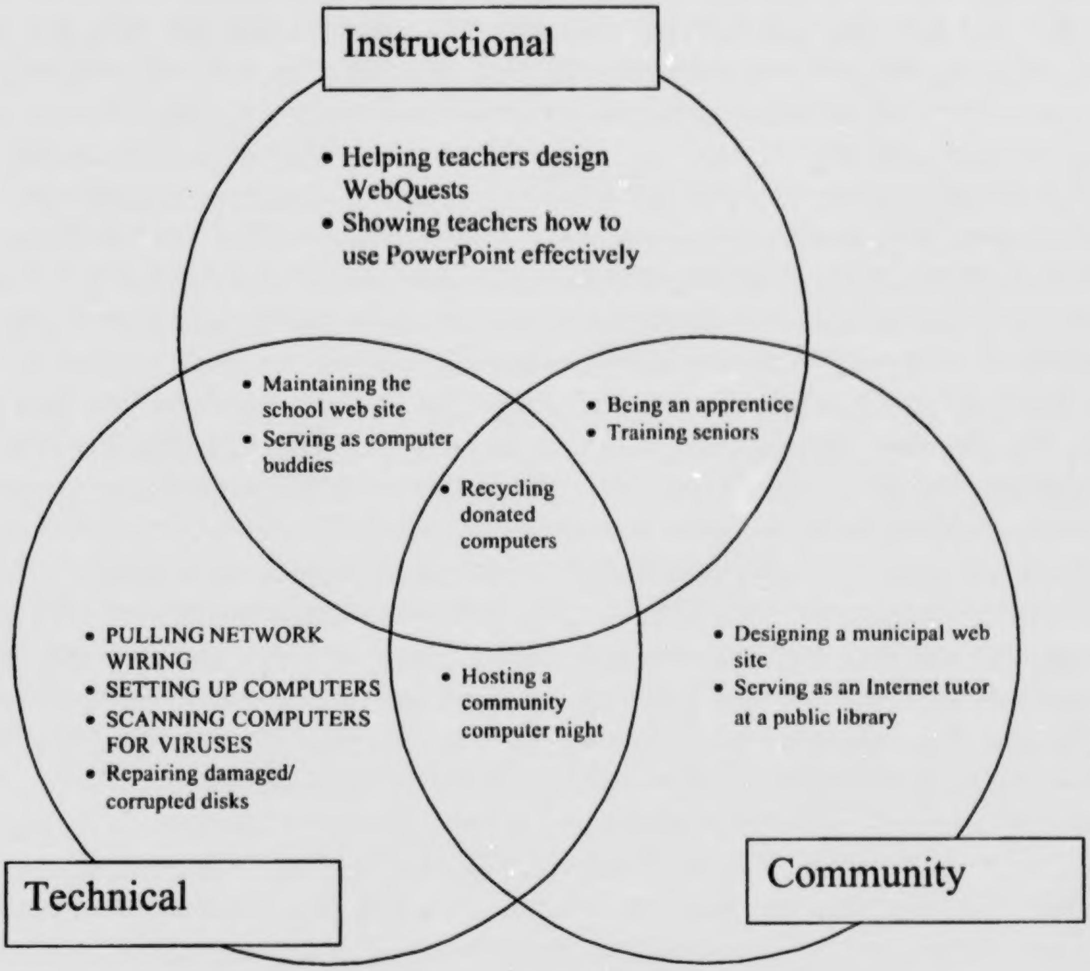
Instructional
• Helping teachers design WebQuests
• Showing teachers how to use PowerPoint effectively
• Maintaining the school web site
• Serving as computer buddies
• Being an apprentice
• Training seniors
• Recycling donated computers
• PULLING NETWORK WIRING
• SETTING UP COMPUTERS
• SCANNING COMPUTERS FOR VIRUSES
• Repairing damaged/ corrupted disks
• Hosting a community computer night
• Designing a municipal web site
• Serving as an Internet tutor at a public library
Technical
Community

Figure 1. Three types of service provided by STAs.

Analyzing Existing Resources

Once you have decided what kind of program you want to have, you need to examine what resources are currently available. You may want to gather some data through surveys and analysis of repair times and costs. However, it is important to remember that costs are not just measured in dollars; they are also measured in attitudes and use of technology, so include items about perceptions and use. Additional questions to answer about your school include:

1. Who provides technical support now?
2. Are the support goals being met?
3. What kinds of hardware and software do you have now?
4. What kinds of resources or programs are available at other schools in your area?
5. Are there ways to pool resources with other schools?

Talk to local businesses about your program; see if they may be willing to support it with initial donations of equipment, money, or staff. Are there employers in your area who have expressed an interest in helping prepare students for technology-related jobs? You may have to limit the program scope initially and focus on some high-

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impact projects that will help sell the program to your teachers and to the community. In exchange, this may aid you in finding additional resources that you can then use to take on additional projects.

An STA program is not likely to be successful in the long run if its coordination is simply piled on someone who is already overworked. Whom will you get to coordinate the program? What will that person have to give up in order to do it? Who will pick up the slack? Are there parents or community members who can help? Perhaps in the initial year of the program, the school will need to provide a substitute teacher for one class to allow the coordinator to develop the program.

Make sure the people involved are dedicated to the idea of the program. Kentucky's statewide STA program, SLTP, emphasizes that coordinators must be prepared to serve as communicators, facilitators/mentors, and also managers. The state STLP web site (http://www.kde.state.ky.us/oet/customer/stlp/coor.asp) urges the selection of coordinators who possess the following characteristics:

- Knowledgeable and enthusiastic about technology
- Energetic in pursuing student participation
- Patient in pursuit of accomplishments
- Dedicated to the success for all students and the program
- A leader with excellent organizational skills
- Willing and able to solicit the support of administrators, peers, parents, students, professionals, and community organizations
- Adaptive, innovative, and reliable in fulfilling duties

Initial Planning

There are other questions that merit early consideration. A partial list is offered by the Educators' Technology Center of Indiana:

- How will students be selected/recruited?
- What kinds of help will teachers/technicians be comfortable with?
- What age students will be involved?
- How will students be trained?
- What responsibilities will students have? Who will they report to?
- Will students be paid? Given credit? Otherwise recognized? (http://etc.iupui.edu/pyop.html)

Erica Peto, Esther Onishi, and Barbara Irish have published a handbook *Tech Team: Student Technology Assistants in the Elementary & Middle Schools* (1997), which is available from Amazon.com (http://www.amazon.com) and from the publisher's web site (http://www.linworth.com). The book, which is based on Peto's masters thesis describing the program in use at her Kent (Washington) elementary school, outlines how to publicize, organize, and manage an STA program. It provides lesson plans, sample forms, and strategies. On her school web site (http://www.kent.wednet.edu/staff/epeto/tech_team/), Peto offers ClarisWorks versions of many of the forms in use at her school as well as early drafts of lesson plans and memos included in the book. Particularly useful are her suggestions regarding the selection process of student participants. She describes the many purposes of the interview and written application question:

- To determine the strengths of the student in the area of technology
- To determine the areas in which the student may need more instruction
- To determine the extent of experience the student has in technology
- To determine the ability the student has in working with adults and other students
- To determine the perception the student has as to what is expected of him/her as a Tech Team member
- To determine if the student has given some thought as to how this activity will fit into his/her overall schedule
- To determine the ability of the student to communicate orally and in writing
- To begin to build rapport with prospective Tech Team members

Similarly Lucy Miller, founder of the SWAT approach which is used heavily in North Carolina and elsewhere around the world, is preparing a manual and CD-ROM which will be available for purchase through the SWAT website (http://www.swatweb.net/). Miller encourages e-mail inquiries (lmiller1@nc.rr.com) regarding her fee schedule. Early versions of many of her forms were previously available on the SWAT website, including one form which contained a detailed and explicit parental approval section, "I understand that my child may leave their assigned classes for short periods of time, with teacher permission, to assist other teachers and students with computer related activities. These activities align with the state and local student technology competencies. Membership on the SWAT Team is an enrichment activity and will be monitored by..." (http://prometheus.educ.ncat.edu/users/swat/application.htm). Miller stresses the importance of gaining parental approval in the first stages of the student's application process.

Another helpful checklist of initial considerations is offered by Kristin Kuntz on the Intel in Education web site (http://www.intel.com/education/teachtech/classroom/tech_teams.htm).

Measuring Success

Regardless of the type or scope of STA program you decide to implement, there are several factors that are considered key to success. This section outlines some of these factors in more detail.

Open Participation

One of the false assumptions held about STA programs is that they require a highly skilled student base, and that they are, therefore, comprised of an elite corps of students. In actuality, STA programs are most successful when they are open to all students, even those with poorly developed technology skills. When students participate in an STA program, they are likely to learn from each other and from the training they receive as part of the STA program. There is often a snowball effect created once a majority of the students are sufficiently competent. Students who enter the program later are trained faster and often "invisibly" by their peers.

Successful STA programs set specific goals to include students who would not traditionally participate in such activities. Specifically, females, those without computers at home, and those who are academically less successful should be encouraged to participate. It is important to realize that girls tend to shy away from technology around the same time boys begin playing computer games. Too often these behaviors lead to a technology gap in high school that is never closed. Involvement in an STA program may address the long-term goal of promoting technology skills for girls. Similarly, students without computers at home often do not develop good technology skills. Including such students in an STA program can often help close the digital divide we read about every day. STA participants who are at-risk academically may develop more positive attitudes towards school and begin to view themselves as valuable members of the community.

Clearly Identified Mission, Goals, & Objectives

When starting an STA program, you need to be very clear about the mission, goals, and objectives for your program. The mission and goals guide how you will develop your program. They help you communicate to the community and other potential sources of funding exactly how you have been successful and what you intend to do with any donated equipment, time, or funds. They also ensure that, when asked, individual members of the program give consistent and accurate descriptions of the program to those who may question what the value or purpose of the STA is for the participants.

External Motivation

While the intrinsic motivation provided by STA programs can be high, some schools offer external motivation in the form of an hourly wage, typically in the range of $5 or $6 an hour. Another possibility is to offer scholarships or awards such as the two BellSouth STLP Scholarships given each year to seniors who have excelled in one of Kentucky's STLP programs (http://162.114.158.30/scholar/new.htm). The STLP annual conference for students provides students the opportunity to travel and to be recognized for their work. The STLP model also provides external motivation for schools and school districts in the form of Diamond, Gold, and Silver recognition. Recognition of community participants can also help boost community involvement.

Training & Support

While some students and teachers who want to participate in your STA program may have skills, not all will. And someone who has technical know-how may not know how to apply those skills within the context of your STA program. Regular training for current and new STAs is required for the long-term success of a program. In addition, those who coordinate the program must get the support and time they need to manage the program effectively.

Organized and Effective Collaboration

Your STA program needs to have a visible presence and contact person in the community. Interested individuals need to have easy access to program leaders in order to propose ideas or volunteer services. Students will grow through exposure to your community's multiple points of view and cultures. Again, this can't be done easily by a teacher or staff member who is coordinating the program in addition to other duties. It is probably best accomplished by the involvement of several community and business members who serve as leaders in the program.

Six Successful STA Programs

Table 1 provides six examples of STA programs in place in K-12 schools today, along with a brief description of their areas of focus. This is followed by a more in-depth analysis of these programs and their components.

Table 1 Profiles of Six Student Technology Assistant Programs

Program	Type of program	What it does/more information
Issaquah School District Technology Information Project (TIP)	Primarily Technical	Probably the first formal STA program, TIP is offered as a middle school and high school course that includes work toward technical certification. http://www.issaquah.wednet.edu/district/tip.htm
Students Recycling Used Technology (StRUT)	Primarily Technical	Founded by Intel and the Northwest Regional Education Service District, StRUT became a statewide Oregon program in 1997-98. StRUT students evaluate, repair and refurbish donated computers and in turn donate those computers to local schools. The program has been replicated in other states. http://www.strut.org
Generation Yes	Primarily Instructional	An outgrowth of Olympia (Washington) Network Navigators clubs, this program has received federal funding and recognition. Its curriculum teaches students the technology, presentation, and mentoring/teaching skills that they then use to help teachers integrate technology into their classrooms. It has recently expanded to include three additional curricula – one focused on community projects, one focused on network maintenance, and one addressing issues of students who "don't like computers." http://www.genyes.org
Kentucky Student Technology Leadership Program (STLP)	Technical, Instructional, and Community-Related	This well-organized program is administered on the state level and promoted in districts and schools across the state. Each year students participate in a statewide conference. http://www.kde.state.ky.us/oet/customer/stlp
Students Working to Advance Technology (SWAT)	Technical, Instructional, and Community-Related	SWAT is a network of schools that embrace the organization model developed by Lucy Miller in which students are assigned to task forces. Many SWAT schools are in North Carolina where students participate in a free statewide summer program. http://www.swatweb.net
Tech Team	Technical, Instructional, and Community-Related	This program's details have been well-documented by its founder Erica Peto and two classroom teachers who are active in the program. Documentation is geared toward elementary and middle schools. http://www.kent.wednet.edu/staff/epeto/tech_team/

Issaquah School District Technology Information Program (TIP)

The Technology Information Project (TIP) varies in its implementation from school to school within the Issaquah School District (http://www.issaquah.wednet.edu/district/tip.htm). However, in general all of the TIP programs follow an apprenticeship model of training. One former TIP coordinator, quoted in a Microsoft in Education case study (http://www.microsoft.com/education/planning/implement/system_issaquah.asp), described his motto: "Every computer here is equipped with a teenager."

At the middle school level, all students are welcome regardless of their prior experience with technology. Students pledge to teach each other. At the high school level, students are expected to bring prior experience and skills. They are carefully screened during an application process that includes an ethics test and a teacher recommendation. Students accepted into the program receive course credit. In some cases, basic skills are taught not only through authentic learning assignments but also through a certification preparation program. In addition to these basic skills, TIP programs stress "an appetite for life-long learning and goal-setting" (http://www.ims.Issaquah.wednet.edu/isdtip.htm).

Sample TIP projects include the following:

- Provide afternoon access to the school computer lab and library computer facilities
- Provide technical support for feeder schools and community centers
- Maintain the school's user network and mail accounts
- Help monitor security and space issues on the school's network
- Maintain and install all network wiring for the school
- Provide routine maintenance and technical support for the school
- Help train staff and students on the use of the school's computer workstations

The student-maintained TIP page for Liberty High School describes the philosophy of that school's program and its emphasis on public presentation of student work (http://www.liberty.issaquah.webnet.edu/TiPpage/philosophy.htm): "Imagine how it feels for a sixteen year old to get up in front of a group of 'suits' some 300 strong and actually have them TAKING NOTES as you speak."

The following individual schools maintain TIP web sites:

- Issaquah Middle School
    - http://www.ims.issaquah.wednet.edu/isdtip.htm
- Issaquah High School
    - http://www.ihs.issaquah.wednet.edu/ihstip/
- Liberty High School
    - http://www.liberty.issaquah.webnet.edu/TiPpage/

Students Recycling Used Technology (StRUT)

Another technology-focused STA program, StRUT, was co-founded by Intel and the Northwest Regional Education Service District in Oregon in 1995 (http://www.strut.org). The program was designed to refurbish and make use of donated computer equipment. Specifically, the goals of the program are as follows:

1. To develop programs where students gain valuable technical and business management skills by assembling, testing and loading software on donated computers.
2. To place these computers in schools throughout the area to supplement those purchased by the district.
3. To work with business partners to reduce the barriers preventing schools from accessing the Internet and other communication technologies.

StRUT has expanded to each of the 21 districts in Oregon. To date, more than 1,000 students have been involved in the StRUT program, and these students have refurbished over 15,000 computers and donated them to more than 70 schools. In 1999, StRUT received Oregon's SOLV Citizenship Award.

Most StRUT programs are run as after school clubs that emphasize field trips and rigorous participation in certification programs such as A+ and Cisco. Some StRUT programs have joined forces with Cisco Networking Academy to enhance this training. One such program is West Albany High School's Computer Networking Program. Its coordinator Dave Hudson is a 1999 recipient of the Oregon Innovators in Education Award. His report on the program is available online (http://www.osba.org/salute/2000/sal0002.htm).

The StRUT alliance, as an example of a technical STA program, has proven to be so successful that it has expanded beyond Oregon's boundaries. StRUT is being implemented in six other states – Arizona (http://www.azstrut.org/), California, Georgia (http://www.sandersvilletech.org/gastrut/), Massachusetts, New Mexico, and Texas (http://www.txstrut.org/).

The following individual Oregon schools are among those maintaining StRUT web sites:

- Sam Barlow High School
  - http://www.gresham.k12.or.us/strut/default.html
- Spray High School
  - http://www.spray.k12.or.us/strut/strut.htm
- Nestucca High School
  - http://www.nestucca.k12.or.us/strut.htm

Generation YES

Generation YES (Youth and Educators Succeeding), a third STA program with roots in the Pacific Northwest, initially focused exclusively on instructional issues (http://www.genyes.org). Even now, the primary curriculum offered by Generation YES (variously called Gen YES, Gen Y, and Gen www.Y) is a training program that prepares students in grades 3 through 12 to serve as mentors to teachers who are integrating technology into their classroom teaching. Graduates of this semester-long program can now continue with the Gen DID curriculum (which focuses on a major community project). Students who demonstrate maturity and technical skills may enroll in the Generation SCI curriculum (Students Caring for Infrastructure, which focuses on computer network maintenance). A fourth curriculum, Gen GIT (Girls' Issues and Technology), is designed to meet the needs of girls who "don't like computers." The more than 500 schools in 41 states affiliated with Generation YES now constitute probably the most widespread STA network in the country.

An outgrowth of the Olympia School District's Network Navigator mentoring program, Generation YES received a federal Technology Innovation Challenge Grant in 1996. Dennis Harper, author of this initial grant, still serves as executive director for Gen Yes, which is now administered by the Office of Educational Research and Improvement (OERI). The Generation YES curriculum kits, which are aligned with the International Society for Technology in Education (ISTE) National Educational Technology Standards, are available for purchase through the ISTE bookstore (http://www.iste.org/Bookstore/index.html). The ISTE magazine *Learning and Leading with Technology* profiled Generation YES in October 1999 (http://www.iste.org/L&L/archive/vol27/no2/features/harper/index.html) and regularly features the writing of Gen YES students in its "Student Voices" column. In 2000, the U.S. Department of Education's Educational Technology Expert Panel recognized Gen YES as one of only two "Exemplary Programs" (http://www.ed.gov/offices/OERI/ORAD/LTD/newtech_progs.html). Most recently, *USA Today* highlighted the program in an August 8, 2001, back-to-school article (http://www.usatoday.com/life/cyber/tech/2001-08-06-students-tutor-teachers.htm).

Students who participate in the basic program enroll in a semester-long (18-week) course to learn necessary technical skills and integration techniques to help their teachers with technology-related lesson planning. The program does not require students to have prerequisite technology skills, but the challenging nature of the curriculum does require significant student effort. Each student is paired with a teacher to assist with a lesson or project's technology integration.

In one such project for a social studies class, an STA helped a teacher develop a unit on Graham County history that made use of a scanner, digital video camera, Avid Cinema editing software, and Photo Deluxe image editing software. The teacher and the STA filmed different historical sites around the county using a digital video camera. Students in the teacher's class meanwhile collected pictures of Graham County that were then scanned in and combined with the video, which was edited to include music. The video was then shown to the class as part of the unit on the history of Graham County, and students were tested on the content.

Another project developed for a science class took a chapter from the class textbook and created storyboards for the chapter. These storyboards called for pictures and images for illustration, which were gathered from the Internet, the textbook, and other print resources. Images were scanned as necessary and, combined with the storyboards, were then used to create PowerPoint slides. The teacher presented the unit to the class.

In a third project, for an English/Language Arts class, an STA worked with the teacher to teach students how to use a digital camera to take pictures and how to edit those pictures in an image editing program. As a practice assessment, the teacher and students went on a scavenger hunt, taking pictures of specific objects and then editing them. The teacher and the STA developed "story starters" which the students then elaborated, continuing the stories and illustrating them with digital photos. More projects and information can be found at http://www.genyes.org/genwwwy/.

Below are just some of the web sites of participating Gen Yes schools:

- Argyle Central School (Argyle, New York)
    - http://www.nheeep.org/SchoolWebs/argyleweb/Programs/GenY.htm
- Birmingham High School (Los Angeles, California)
    - http://www.lausd.k12.ca.us/Birmingham_Magnet_HS/GENYWEB/
- Thurgood Marshall Middle School (Olympia, Washington)
    - http://kids.osd.wednet.edu/Marshall/homepage/thurgoodmarshall.html

Kentucky Student Technology Leadership Program (STLP)

Kentucky's Student Technology Leadership Program (STLP) exemplifies a state-organized STA program (http://www.kde.state.ky.us/oet/customer/stlp). According to its web site, 828 Kentucky schools in 165 Kentucky school districts currently participate. Although at first glance its vastness and organizational complexity may seem intimidating, many of STLP's features are noteworthy even for rural schools who are considering implementing a small-scale STA program. Specifically, Kentucky's program involves students in technical, instructional, and community-related projects, making its usefulness broader than one specific area. Additionally, the program provides local districts with state-level guidance, a feature that helps insure that proper instructional objectives and standards are being met. The state-organized nature of the program allows for more uniform development and collaboration across the state. State-run competitions and student conferences assure that students work hard to maintain a high quality of work.

Kentucky's STAs have performed a number of technical-related tasks. Specifically, they have created and maintained web pages, wired classrooms and laboratories, produced videos, and assisted faculty members with technology-related problems. These projects are varied and numerous and go beyond simple technical troubleshooting.

The instructional projects of Kentucky's program are also broad and diverse. Students have developed brochures, mentored younger students, developed electronic portfolios, evaluated software, and provided technical instruction. One STA school developed a PowerPoint presentation on the state of Kentucky using graphics and sounds of the state bird and the state song. Another STA school implemented electronic portfolios of HyperStudio work, studied and reported on technology related issues such as Y2K, developed web-based curriculum, illustrated poems with digital pictures, built WebQuests for several topics, created audio/video broadcast coverage for campaigns and a shuttle launch, and generated a variety of print-based materials such as news letters and newspapers. In another school, students reviewed software programs and then held a showcase to introduce the software to teachers. Another project enlisted STAs in helping parents learn how to use the Internet during weekly "Internet night" workshops. STAs in yet another program developed a program called "Technology Opportunities in the Library." Teachers attending this program learned how to use a digital camera, a scanner, HyperStudio, and a Laserdisc player. Ideas for integrating these technologies into classroom curriculum were also presented. There are also scores of instances where STAs have helped teachers and community members learn to use programs like Excel, Powerpoint, and Hyperstudio; to troubleshoot and maintain classroom computers; and to use a variety of hardware.

STLP has generated hundreds of community projects. Students in this program have helped maintain city web sites and build and maintain web sites for community organizations and schools. They have converted networking systems and installed computers for neighboring schools, conducted research and web page maintenance for local companies, and taught community education classes in PowerPoint and other software applications. They have made holiday cards and large-print phonebooks. They have held workshops for senior citizens in assisted-living facilities, managed and supported a lending library for software and hardware open to the community, and created business cards and pamphlets for local organizations.

Providing technical, instructional, and community-related assistance to others follows the mission of Kentucky's Student Technology Leadership Program. The STLP mission aims to advance the individual capabilities of all students, to motivate all students, and to create leadership opportunities through the use of technology. The specific goals of this mission are as follows:

- The STLP will develop activities that enhance the academic, social and emotional growth of the student.
- The STLP will provide leadership opportunities for all students.
- The STLP will experience multi-age collaboration by forming innovative learning partnerships.
- The STLP will form learning partnerships between students with different technology skills.

- The STLP will develop activities that benefit communities.
- The STLP will develop instructional activities which integrates technology and benefits the school and support KETS (Kentucky Education Technology System)

From its inception, these six goals have guided STLP. In her 1999 *Learning and Leading with Technology* article, Elaine Harrison describes the advisory council that formulated these goals and structured the program in its early days. She notes, "The Kentucky Department of Education gave grants ($1,000 per year) to the initial STLP schools for the 1994–95 and 1995–96 school years." Online manual materials describe the program's structure – an adult STLP coordinator for the school and student cluster coordinators for individual projects – and the process followed to create a unified action plan that meets the program's six goals.

One notable aspect of Kentucky's program is its inclusiveness. The program strives to include a population fully representing the school's diversity. This means that the program aims to draw females, minorities, and special education students. Activities are scheduled with a flexibility that assures that no student is excluded on the basis of schedule. As a means of assuring inclusiveness, the STLP program stresses four important roles for students involved in the program – starter, liaison, trainer, and provider.

Below is a sampling of individual STLP web sites:

- Charles Russell Elementary School
    - http://crussell.ashland.k12.ky.us/stlp\stlp.htm
- Paul Lawrence Dunbar High School
    - http://www.pldhs.com/stlp.html
- Region 6
    - http://www.k12.ky.us/oapd/rsc6/stlp.asp

SWAT – Students Working to Advance Technology

Another nationally recognized STA program, SWAT, focuses its efforts on student leadership training, technology integration, and community outreach. Although the program has been implemented across the nation, individual programs are expected to each have their own personality. SWAT teams, as many implemented programs have been called, are supported by guidelines (http://www.fetc.org/fetcon/1199/swat.html), yet each of the programs are expected to assess the technological needs of their local school and community.

Students who are interested in participating in a SWAT program are usually required to complete a job application and complete an interview. In this way, teachers can more appropriately evaluate the types of programs to embrace, and perhaps more importantly, to effectively match students with technology tasks.

After assessing the technology needs of the local school and community, those who are implementing the SWAT program are encouraged to do the following:

- Communicate concerns with administrators, teachers, and the community
- Develop a program mission, with goals, priorities, a plan of action, and a method of evaluation
- Announce the plan to the students
- Distribute applications and obtain parental permission
- Conduct interview to build SWAT teams
- Assess the technology needs of the local school and community
- Train the students
- Monitor and evaluate the program

Task Force Teams, the organizational name given to a job that a student is assigned to complete, can include any number of responsibilities. Examples of these teams include the following: TV/Weather Internet Crew, Internet Researcher, Web Master, and Computer Buddy. Of course, the possibilities are limitless for teams and responsibilities. But again, local needs should drive the development of teams.

During summer 2001, the second annual SWAT Camp was offered to North Carolina's SWAT students at seven CyberCampuses <http://www.dlt.ncssm.edu/swat/swat_camp.cfm>. The program, which is free to students, is funded through a Technology Innovation Challenge Grant.

One web site hosted by the North Carolina School of Science and Mathematics serves as a resource for ten high school SWAT programs in North Carolina <http://www.dlt.ncssm.edu/SWAT/index.cfm>. This consortium of SWAT programs is currently planning a portfolio process by which students can become "SWAT Team certified" in web page design: "Certification implies that the student is capable of designing pages for school community members and organizations."

Below are a sampling of other school web sites affiliated with SWAT:

- Narragansett Elementary School (Narragansett, Rhode Island)
    - http://www.ri.net/schools/Narragansett/NES/SWAT/swat.html
- Eastview Elementary School (Connersville, Indiana)
    - http://fayette.k12.in.us/eastview/computerclub.html

Tech Teams

Erica Peto's model for TechTeams has been cited as an influence for a variety of programs, including the Ballard Tech Team, which is a featured School Web Clubs web site <http://supportnet.merit.edu/webclubs/featured1.html>. In a June 2000 *Education World* article, Ballard teacher Marcia Cousins explains, "As the tech people in our building, we were becoming more and more overtaxed and overwhelmed with trying to teach and also be the 'techies'... As we added more and more computers, the task increased. Hence, the idea for a tech team evolved. We had the opportunity to see a presentation on tech teams and had the resource of a book -- *Teams, Student Technology Assistants in the Elementary and Middle School*, published by Linworth Publishing [ISBN 0-938865-60-9]. This book is geared just towards a tech team and not a Web club. Ours has developed into both" <http://www.educationworld.com/a_tech/tech035.shtml>.

Similarly, Mississippi's new CREATE (Challenging Regional Educators to Advance Technology in Education, http://www.create4ms.org) program draws from Peto's model in designing student Techno Teams who provide support for the program's technology carts. Schools within the CREATE program are encouraged to gain ideas and inspirations from Peto's workbook but to create tech teams suited for their own schools.

Peto's model, as described on the web site <http://www.kent.wednet.edu/staff/epeto/tech_team>, is designed to meet the needs of her own school, Daniel Elementary, as well as other schools in the Kent School District. As she explains, "The main function of the Tech Team is to assist during media block (a combination of library and computer classes). Tech Team members also help during preschool and Head Start preschool computer center time."

Tech Team members at Daniel are fourth, fifth and sixth grade students who volunteer to miss approximately one hour of class time per week and make up that work on their own: "During this time, they assist students who are learning to use technology and working on technology-related projects. In addition, Tech Team students agree to attend a training session once per week. Last year this training time was held after school but this year it is held during lunch recess."

The school's web site <http://www.kent.wednet.edu/KSD/DE/st_proj/st_proj.html> offers a glimpse of a variety of impressive student projects supported by Daniel's Tech Team members.

Conclusion

As these models demonstrate, STA programs can be an excellent way for schools to promote technology integration, for teachers and students to gain technology skills, for students to become more involved and committed to their communities, and for communities to gain services they could not otherwise get and a more educated workforce. In most cases, the start-up costs are small.

Before embracing one of these models or creating your own, you should first explore what is being done in other schools in your state. Have several schools within your state adopted the Gen Yes curriculum? Does StRUT operate in your state? Is there a large employer in your state interested in helping coordinate a StRUT-like program? Is your State Department of Education considering a statewide initiative such as Kentucky's? Perhaps your state can achieve the synergy Mississippi schools achieved when they applied for and acquired federal funding for the CREATE project.

The key to any successful program must be that it meets the needs of your school and your students. And though STA programs have proven helpful in addressing schools' budgetary crises, no STA program should be viewed as a permanent replacement for budgeted technical support dollars. For the full potential of STA programs to be achieved – technical, instructional, and community – the focus must firmly centered on students' academic needs.

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S.O.S. For Information Literacy: A Tool for Improving Research and Information Skills Instruction

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ABSTRACT

At no time in history has the ability to locate, organize, evaluate, manage and use information, skills collectively referred to as information literacy, been more important to today's learners. Classroom and technology teachers and library media specialists are challenged to find effective, innovative techniques for teaching research and information skills, especially to young children. This paper summarizes the research conducted for a U.S. Department of Education Phase I SBIR award. The project utilized digital video, database, and information technologies, to design a proof-of-concept prototype for a comprehensive Web-based tool, ***S.O.S.****, for improving instruction in this critical area. Educators identify relevant situation-specific variables* ***(S.)*** *and desired instructional outcomes* ***(O.)****. Suggested instructional strategies* ***(S.)*** *are subsequently generated. These strategies are linked to a database of real-world video and multimedia examples.* ***S.O.S.*** *will be responsive to advancing technology and include system feedback mechanisms as well as direct user input for continuous formative evaluation and improvement. By integrating sound pedagogical principles with real-world practice presented in video and multimedia demonstrations, the project will make a valuable contribution to the quality of information literacy skills instruction.*

Introduction

This paper highlights the main activities and results of an SBIR Phase I project to research and design a proof-of-concept prototype for improving instruction in information literacy. It utilized digital video, database, and information technologies in a comprehensive tool, ***S.O.S. for Information Literacy***, for improving instruction in this critical area. Educators identify relevant situation-specific variables ***(S.)*** and desired instructional outcomes ***(O.)***. Suggested instructional strategies ***(S.)*** are subsequently generated. These strategies are linked to a database of real-world video demonstrations.

A high degree of success was achieved for all Phase I objectives. Top level objectives included 1) performing a front-end analysis to determine how best to design a Web-based information system that meets the needs of its target audience (elementary library media specialists and teachers) 2) designing the Phase I specifications (e.g., scope/organization of content, project curriculum, and design specifications for the proof-of-concept prototype, 3) producing the Phase I prototype including data structure, sample videos, and user feedback mechanisms, and 4) evaluating the proof-of-concept prototype across a number of variables including ease of use, technical reliability, quality of content, interface design and general appeal. Major accomplishments included:

- The development of an online Research Management Site provided an excellent environment within which the Phase I research activities occurred and will prove useful as the project continues into its development phase.
- A survey of 192 practitioners supplied critical information on the target audience's needs and preferences as well as clarification of a number of content issues.
- A questionnaire to faculty and leaders (n = 8) illuminated the need to add several subskills to the search parameters in Phase II, and provided useful information for dissemination of S.O.S. project information.
- Input evaluation resulted in guidelines for software development and video production.
- Production, post production, and compression of 18 sample videos demonstrated that quality video could be delivered via the web at high compression schemes.
- Sophisticated data structure and query systems were the outcomes of software development over two iterations of the proof-of-concept prototype.

- A Focus Group (n = 11) of potential users helped to elucidate the results of the earlier practitioners' survey and to beta test the first iteration of the prototype.
- Evaluation of 2^{nd} iteration prototype by a Progressive Feedback Panel (n = 11) yielded valuable information for Phase II development relating to functionality, technical quality, and interface and design issues.

The remainder of this paper will briefly discuss each of the above accomplishments, and conclude with information on current development efforts.

Development of Research Management Site

The Research Management Site (RMS) was a controlled online environment within which the Focus Group and Progressive Feedback Panel activities took place. The Focus Group (which will be described later) tested the first iteration prototype while the Progressive Feedback Panel tested a later version. The RMS was first developed in HTML and then brought into the WebCT Courseware so that threaded discussions could take place. Additionally, it served as a jumping off spot to link to the S.O.S. beta test site and as a return point to continue in the Focus Group or Progressive Feedback Panel mode. The success of conducting research within the RMS environment in Phase I has set the stage for successful research efforts in Phase II.

Results of Online Practitioners' Survey

A 40-item survey was designed to gather feedback on potential curriculum content, perceived usefulness of the product, and plans for current and future technology implementation in respondents' schools and homes. The survey was designed as a comprehensive set of items including multiple choice, short answer, and open-ended questions. The first draft of the survey was piloted with 32 graduate students enrolled in a class called "Instructional Strategies and Techniques for Information Professionals" at Syracuse University, School of Information Studies. The pilot test served three purposes: 1) test the appropriateness of the survey's dissemination medium, 2) test the robustness of the dissemination medium, and 3) garner item feedback. After some modifications the survey was announced on several listservs (e.g. LM_NET, ED-TECH) and 192 library media specialists, teachers, and technology coordinators responded.

Ninety-four percent (94%) of respondents indicated that the S.O.S. system as described would be either "useful" or "very useful" to library media specialists and 85% felt it would be "useful" or "very useful" to classroom teachers. Participants were given a number of potential uses for S.O.S. and, while the majority indicated the importance of all the options, using S.O.S to help with lesson planning (85%; 163) was the highest rated response. Stimulating ideas (80%; 152), providing background information (67%; 127), and allowing practitioners to compare strategies provided with current practice (65%; 124) were also highly rated uses. Fifteen (8%) indicated "other" (e.g. professional development, use in education courses). Information was also gathered on information skills and subskills to include in the system. Respondents overwhelmingly agreed that the inclusion of lesson plans would be a highly motivating component of S.O.S. and that standards tie-ins would also be important.

Questionnaire to Selected College Educators and Leaders in the Field

The purpose of the questionnaire was to gather consensus on the appropriate scope of content to include in the S.O.S. tool and to gather feedback on the proposed features of the tool. A group of 11 individuals was initially targeted for participation. Eight of 11 responses were received. The results of this survey were clarifications of several skills and the addition of several subskills to search options for the tool in Phase II. This group provided useful suggestions for publicizing and motivating educators to use S.O.S. Respondents also provided a number of suggestions for S.O.S. features which included:

- A listserv to allow people to trade comments and make suggestions as well as contribute lessons
- A way to add comments/reflections to the site which would then be available to others to peruse
- Printable lesson plans
- Links to content standards
- Lessons that reflect collaboration with classroom teachers in specific subject areas
- Printed transcripts of video/audio clips

Input Evaluation

Early on, an input evaluation was conducted in-house and extended to several outside consultations with technology persons who frequently work with Creative Media Solutions. Technical specifications for software development were considered and a preliminary web-based data entry structure was planned using an SQL client/server environment. Many video issues were also considered such as what features were accessible by the majority of educators that would be testing our product and what long-range features could be anticipated for the ultimate release of the product. Decisions about frame size, delivery format, and compression algorithms were made after testing factors such as download time of various options with typical users' computer systems. These decisions are discussed further in the sections below.

Video Production and Acquisition

Only original materials produced by Creative Media Solutions were planned for the prototype. Eighteen videos were included in the prototype ranging in length from approximately :25 to 4:30 minutes. Teachers and librarians from 4 Northeast states participated: New York, Pennsylvania, Massachusetts, and New Hampshire. In addition to videos produced entirely by the company, two videos were compiled from still photos sent in by a school in a Boston, Massachusetts suburb. Photos covering a six-week unit by a teacher in New Hampshire were also compiled into a multimedia PowerPoint presentation.

The style of production is similar to ENG production (electronic news gathering) in that the production team consists of the producer and videographer and sometimes an assistant. This is necessary because what happens in the course of a teaching episode is not entirely predictable; sometimes the camera is on the tripod and other times it is simply handheld. The production team attempts to be as non-intrusive as possible during the videotaping. There is generally little discussion ahead of time as to where in the library media center the librarian or students will be at any one time. The videographer simply documents the events.

With several exceptions, the production team was not allowed to videotape children's faces. This posed a challenge but did not compromise the quality of production.

The library media specialist was generally interviewed *after* the teaching episode. By conducting the on-camera interview afterwards, the producer/interviewer could frame her questions in the context of the actual lesson and the reactions from children she observed.

Each raw videotape (unedited field tape) was reviewed and shots or soundbites (also referred to as "clips") logged using timecode that would help to demonstrate a particular strategy. Scripts were written to guide the editing process providing detail on all shots selected including their sequence and sometimes duration. Interview soundbites were included and narration was written where needed. Any transitions (e.g., dissolves, wipes, etc.), music/effects, and text were also noted in the script. Voiceovers were recorded when appropriate.

The selected clips and voiceovers were then captured into the computer using Firewire and digital capturing software made by Pinnacle. Next, the captured clips were brought into editing software such as Media 100 or Adobe Premiere (for this example, Adobe Premiere) and laid out on a timeline. Titles and identifying text were created including a summary of the strategy used. Voiceovers were added when indicated. Transitions were created.

The timelines with all their elements were rendered as complete movies in AVI uncompressed format at 360 X 240 pixels down from their original size of 720 X 480 pixels. As planned, the finished AVI movies were taken into another industry standard program called Media Cleaner Pro for compression and . reduced to a 240 X 180 pixel frame size and rendered with Sorenson compression at 15 frames per second with audio at 22 kh.

The final step was adding the video to the video demonstration database to be linked to strategies and lesson plans.

Two professional looking albeit simple (in terms of video production techniques) videos that the Progressive Feedback Panel felt represented an acceptable alternative to only motion videos in the database were created from still photos sent in by a teacher in Massachusetts, proving to be a viable and cost-effective alternative to only motion videos.

A number of implications for future acquisitions of video content were determined. They include but are not limited to loaning library media specialist/teacher teams digital video or digital still cameras for 2 - 3 months at a time to capture teaching *in action* clips. The equipment would be bicycled to different areas to expand geographic coverage. The alternative production method, mentioned earlier, of using still photos to create a video would also open up participation to many individuals. All footage and stills would be sent to Creative Media Solutions for post-production including adding voiceovers, titles, etc., helping to maintain a consistent look. Online training resources to be developed in Phase II could help prepare teams for acquiring video and preparing their work for submission to the S.O.S. project.

Development of Data Structure and Query System for Initial Prototype

Phase I technical development goal was to collect information from a variety of sources, provide a mechanism to enter or query data, and deliver a wide variety of media as efficiently as possible to a diverse market. This solution was then integrated into a comprehensive Web site.

Data Structure. A relational database was custom developed to insure all facets of the project goals could be realized. A number of changes and additions were added to the database over the development cycle. Bringing the vision of the academic information literacy professional and translating into technical development introduced a series of challenges that were overcome. The solution consists of over thirty data tables, hundreds of data relationships and a client server interface as well as a Web interface. The final product has almost no artificial limits to data entry. Strategies can be related to lesson plans, lesson plans can be related to strategies and an unlimited number of resources can be attached to either. Supported resources include but not necessarily limited to; QuickTime video, Power point, text, QuickTime audio, pictures, and Web links. Special care was taken to allow content to be cross-referenced.

Another important aspect to consider was data entry. The user interface was designed to allow professional staff to quickly learn the necessary skills and offer automated entry functions when possible. Feedback on navigation, view, data required on screen and the complexities of identifying all the associated links were all considered. This is an evolving process, but the current solution has met the data entry requirements to this point.

Query. Query screens fall into two categories. Within the client server environment, queries have relatively unlimited options and occur very quickly. The query is an integrated function of the development software. As the complex data relationships that empower the information are ported to the web, significant slowdowns occurred. This was an anticipated result and a number of solutions are possible. The initial investment was made in understanding the data flow and allowing for the data to be entered correctly. As indicated above, this led to a number of adjustments. Optimization of code occurs in logical sequence, and every adjustment has a potential ripple effect throughout the code that is not always possible to predict. The next phase of development will focus on additional data indexing; relationship based queries, and a continued focus on utilizing the best technology tools available at the time of product delivery. During Phase I, the focus was on utilizing Active Server Pages with SQL queries embedded into the HTML page and CHTML tags with proprietary software. We feel that all issues of query speed from a Web centric view will be resolved transparent to the user. It is also anticipated that more features will be added to the data structure that will impact the solution as development continues.

Data delivery. Data delivery from the Web site introduced a number of variables inherent in the diverse world of Internet users. The expectation was data would be accessed by a current Web browser, would require Flash and Quicktime plug-ins, and the user would have dedicated Internet access. This expectation was not what occurred. This solution requires the ability to develop and distribute complex pieces of information. Multiple versions of multiple browsers demand constant day to day troubleshooting. From our research, we can see just how problematic this can be. For example, Netscape, particularly in earlier versions, did not fare as well as Internet Explorer with our prototype. There is a wide array of variables unique to each browser and specific version. The problem then becomes "which version do we adjust code to support"? As mentioned previously the effect of software adjustments at one level can and will affect results in other levels. Some panel members using both old browsers and old "systems" required technical support from our staff in order to complete the research. The compatibility problem is further complicated by the fact that competition has the various browsers introducing newer, better, faster features but that the different browsers (while trying to maintain competitiveness) still do so at different paces.

A decision that faces every developer is whether to adjust code to the lowest common denominator approach or choose a solution somewhere between the lowest and the highest common denominator. This project demands fairly complex searches on multiple variables. It includes videos, some of which can be up to four or five minutes in length. What our research is indicating, from a technical perspective, is that the lowest common denominator approach will not be the best one for this project. While some web databases do just fine with this approach, they do not have the many additional variables to deal with as one such as the S.O.S. project with its multimedia content.

Judging from the results provided by users, the complexity of supporting multiple browsers limits delivery options to an unacceptable level. Internet Explorer version 5 or greater has proven to be the most reliable with this project. Current versions of Internet Explorer and Netscape will likely be recommended as viewing engines. Perhaps, by the time this resource is available, the browsers will have achieved an overall consistency that eliminates this issue. For now, the delivery goal will dictate browser selection and support. Browsers are typically free, are upgraded regularly, and have many settings and options to enhance web experiences.

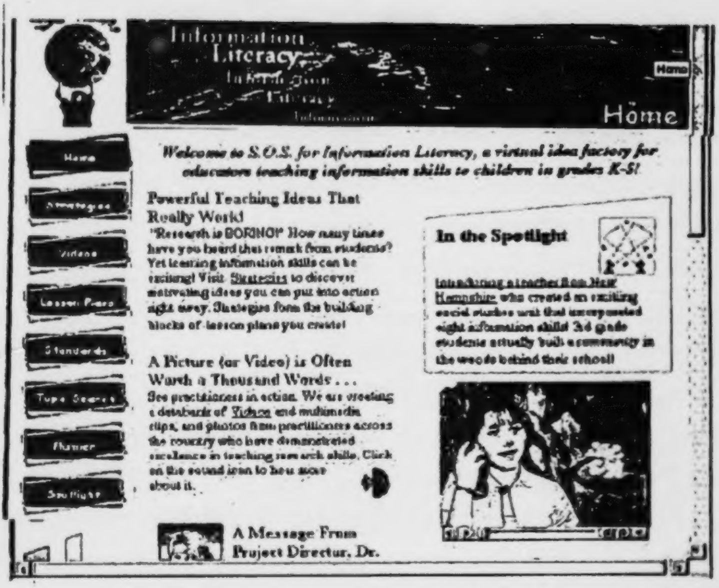
Will our decision eliminate many potential users? The question is not whether the site can be viewed, but more precisely can the site be experienced to the full potential. It is not unusual today to see messages such as "best viewed by..." While we may lose some users, we will try to minimize that loss by making the necessary software or upgrades easily available to the user. Furthermore, most current computer operating systems include versions of both Netscape and Internet Explorer. Navigating the site in the preferred browser should be less of a problem. Information reduces anxiety. Providing information to the user about technical needs for an optimum experience will also reduce possible frustration when problems are encountered but users don't know why.

Results of Focus Group

The Focus Group consisted of 11 pre-service and in-service educators (potential future users of S.O.S.) most of whom were library media specialists. They were from New York State, North Carolina, and Virginia. Because of the distributed geographic location of focus group participants, all focus group sessions were conducted online using the Research Management Site and WebCT's asynchronous discussion feature rather than the traditional face-to-face method. The Focus Group provided valuable feedback on important issues that related to the scope of content, inclusion of standards, value of lesson plans, variety of videos, amount of information presented in videos, links, and a number of other issues. At this point in the research, only content and curriculum related issues were explored. Interface and design issues were not addressed in the Focus Group. They reviewed content issues in the context of a very plain and simple interface on a beige background. This group also provided input that resulted in the adoption of the national information literacy standards put forth in *Information Power: Building Partnerships for Learning* published by the American Association of School Librarians (AASL) and the Association of Educational Communications and Technology (AECT) in 1998, as the basis of the standards search. Quality control of content was also considered an important attribute of the future tool. The Focus Group provided a number of possible ways to insure quality control of content including a quality assurance committee, expansion of the online feedback mechanism, and the development of an evaluation tool. The consensus seemed to be that anything uploaded to the S.O.S. site should be considered a quality product.

Evaluation with Progressive Feedback Panel

Based on feedback and recommendations from the Focus Group, the development team made modifications and additions to the initial prototype for testing with another group of educators described below. In this iteration, videos were linked to the strategy or lesson plan generator in which search variables included specific situation (grade and context) and outcome (information skills and subskills) variables. The results of such a search are strategies or lesson plans which have links to a video/multimedia database. We also added a video **"quick search"** where a user can search on a video topic using only a topic keyword.



Welcome to S.O.S. for Information Literacy, a virtual idea factory for educators teaching information skills to children in grades K-5!

Powerful Teaching Ideas That Really Work!
"Research is BORING!" How many times have you heard that remark from students? Yet learning information skills can be exciting! Visit Strategies to discover motivating ideas you can put into action right away. Strategies form the building blocks of lesson plans you create!

A Picture (or Video) is Often Worth a Thousand Words . . .
See practitioners in action. We are creating a database of Videos and multimedia clips, and photos from practitioners across the country who have demonstrated excellence in teaching research skills. Click on the sound icon to hear more about it.

In the Spotlight
Introducing a teacher from New Hampshire who created an exciting social studies unit that incorporated eight information skills! 3rd grade students actually built a community in the woods behind their school!

A Message From Project Director, Dr.

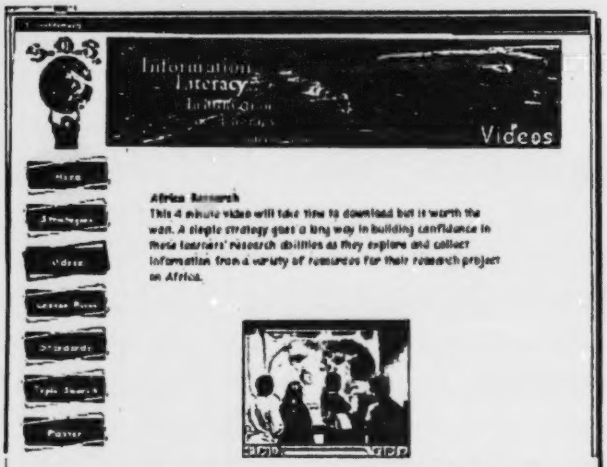
Figure 1: Screen capture showing top half of homepage illustrates interface design of 2nd iteration prototype

A comprehensive questionnaire was developed by the principal investigator and senior project consultant that would elicit feedback in two main areas 1) Searching functionality across strategies and videos, lesson plans, topics, and standards, and 2) Interface and design. This site was then presented to the Progressive Feedback Panel who helped us evaluate the 2nd iteration of the proof-of-concept prototype in the above areas and on specific issues that included: ease of use, features that might attract educators, quality of content, technical quality, menu buttons, color appeal, etc. (Whereas the Focus Group was concerned with content issues and functionality, this group was also concerned with interface issues.)

The Panel consisted of several members from the original Focus Group plus new members. This configuration was chosen to provide a balance between continuity of feedback and fresh input from persons not previously connected with the project. Eight library media specialists, 2 classroom teachers, and 1 district-wide technology coordinator comprised the group. They were given instructions for reviewing the site individually, and subsequently filled out a comprehensive questionnaire.

In addition to rating various aspects of the tool on a scale, participants provided many useful suggestions via open-ended comments. The Panel gave S.O.S. high scores (4.1; n = 11) on the intuitiveness of searching with the Strategy and Lesson Generators (1 = not intuitive; 5 = very intuitive). They gave an even higher score (4.4; n = 11) on the usefulness of the "related resources" which included videos, lesson plans, graphics, etc. Such resources are intended to help clarify, enrich, or reinforce the teaching strategies suggested by the strategy generator.

In terms of quality of video, most comments reflected high enthusiasm for the videos. "This is some of the highest quality [video] I have seen on the web!!!" wrote one respondent. Another wrote: "It is always valuable to hear from colleagues. When I see the enthusiasm of the person in the video, it makes me more likely to try their strategy. The videos are a valuable part of S.O.S." There were some comments, however, that indicated concern about the speed of access of the videos. Some of the longer videos took an extremely long time to load if the user did not have a direct connection to the Internet.



Africa Research
This 4 minute video will take time to download but is worth the wait. A simple strategy goes a long way in building confidence in these learners' research abilities as they explore and collect information from a variety of resources for their research project on Africa.

Figure 2: Screen capture from selected video depicting current frame size in relation to page.

Participants commented that the voiceovers which were added to some of the videos were of professional quality, helped to clarify points made by the speaker (educator), and were effective in providing transitions.

After seeing two examples demonstrating an alternative video production technique, almost all Panel members agreed that allowing educators to submit photos that could be edited into a video with a voiceover added would provide a valuable alternative to all motion video. An important point was made that many educators still feel more comfortable with a still camera than a video camera. Finally, the opinions were mixed on the value of including video transcripts but one important comment was made that transcripts may be useful for the hearing impaired.

Some Panel members felt the current size of the video frame used in the prototype was

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adequate; others felt it should be twice as large. Figure 2 illustrates the current frame size in relation to the page. The user arrives at the screen in Figure 2 after selecting a particular video from the list of Related Resources (to the strategy or lesson plan) which includes brief descriptions of the available videos. As technology advances allow, we anticipate increasing the size of the video at least two-fold. We selected the current size in order to conduct research with users who would not have been able to accommodate the larger video size at this time due to unreasonable loading times.

Comments were solicited on the usefulness of the search function for information literacy standards. This search is based on the national standards as presented in *Information Power, Building Partnerships For Learning* (1998). Responses were generally positive and included: "This is a good search. Often we are looking for a specific idea to teach a standard required in our curriculum and this will be a good resource for it." Another wrote: "This will be handy when my co-librarian and I are in the midst of our curriculum and benchmarks we are writing based on the ILS [information literacy standards] from *Information Power*. Great examples."

The user can select one of the broader standards or narrow the search to include only those lessons that relate to a specific indicator of the standard. Future development will broaden the search to include all video and related resources as well.

Although not implemented in the prototype, participants were asked to assess how useful it would be to search S.O.S. by nationally recognized content area standards such as those compiled by the Mid-Continent Research for Education and Learning (McREL) in addition to searching by information literacy standards. On a scale of 1 (not useful) to 5 (very useful), this item received a 3.7. One Panel member wrote: "I believe the national standards are adequate. Users can interpolate where the standard they are looking for is within the national standards."

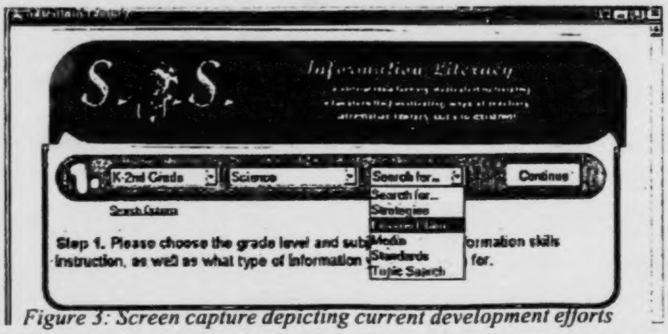
Panel members offered suggestions for improving the Topic Search function including providing drop-down menus of topics, clarifying directions, providing the ability to browse available topics, and adding a help menu. Positive comments included those who liked the "quickness" and "ease" of the search in addition to its potential helpfulness in searching for ideas to integrate into classroom instruction.

From a design and navigational perspective, S.O.S. was well received. It had received a complete overhaul from the simple design and layout of the initial prototype beta tested by the Focus Group. Panel members commented positively on the colors, banner, the appealing look, and layout. One member wrote: "I love the design and colors used in the site . . . the way the menu buttons move is great! I like the logo of the earth and the banner. Information is shared all over the world." That is the message that the banner was meant to reflect and it seemed to be readily recognized.

Finally, comments from both the Focus Group and the Faculty/Leaders Questionnaire had previously mentioned the desirability of including a section where visitors could find news, features, special videos, or other information. This was included in the 2nd prototype iteration which the Progressive Feedback Panel reviewed. The "Spotlight" section of the site was enthusiastically accepted. Responses were almost universally positive. One person commented on its potential value for encouraging collaboration which is one of the project's underlying goals. *"In the Spotlight"* for this prototype included a feature story on a teacher from New Hampshire who cleverly wove eight information skills into a 6-week Social Studies unit on communities. In fact, her students actually built a play community in the woods behind their school as a way of learning the concepts. Also *"In the Spotlight"* was a library media specialist talking about ways to foster collaboration between classroom teachers and library media specialists. This was presented as a video interview. This component of S.O.S. will help the site maintain a current feel and may be expanded in future development efforts.

From Phase I to Current Development

Creative Media Solutions, Inc. is continuing to develop *S.O.S. for Information Literacy* through a strategic alliance with Grant Systems, Inc., as new sources of funding are explored. Since the authors have always planned on making this resource freely available to educators, creative means of sustaining the project are necessary.



Step 1. Please choose the grade level and sub... formation skills instruction, as well as what type of information ... for.

Figure 3: Screen capture depicting current development efforts to produce streamlined searches and simplified design

Already, a number of improvements have been accomplished as a result of the input from the Phase I research. Search screens are now much more streamlined and require no scrolling. After selecting grade levels, subject area, and type of search (see

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Figure 3), for example, the user can select both information skill(s) and subskill(s) in one easy step. The color scheme, considered pleasant (blue and gold tones) by the Progressive Feedback Panel, has been retained but the screen design has been simplified. An online submission template which will allow educators to upload media such as digital stills and PowerPoint presentations along with their lesson plans is currently being developed. As soon as completed, library media specialists and classroom teachers will be recruited to submit materials to populate the database. Once the database has sufficient materials for meaningful queries, it will be made available to educators at large.

Evaluation of all materials submitted to the database will be an important aspect of S.O.S. Before being made available online, new submissions will be reviewed by a two-person team of evaluators using an evaluation rubric similar to that used in the U.S. Department of Education's Gateway to Educational Materials (GEM) project. A Web-based interface for evaluators to review and score submissions is currently being developed.

Finally, the *S.O.S. for Information Literacy* information system will be expanded to include middle school grades.

Summary

The successful completion of all technical objectives for Phase I not only demonstrated the project's feasibility but also provided a strong framework for the successful continuation of the research and development effort. Most importantly, there was a high degree of agreement by educators in each of the research components conducted that *S.O.S. for Information Literacy* would be a valuable and needed addition to improving the teaching of information literacy at the elementary and middle school grade levels.

Online Resources for Teaching Widely-Used Secondary School Texts

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Lauren A. Liang
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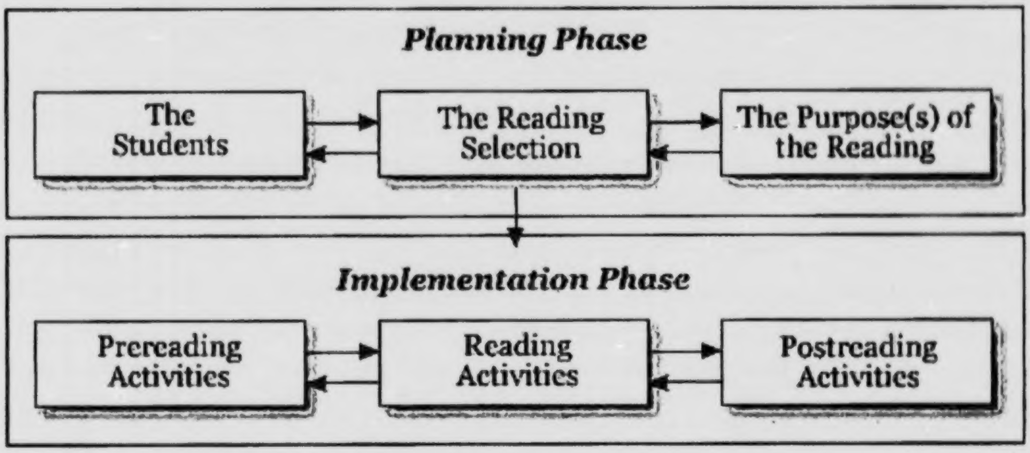
Seward Learning Systems, Inc.

Scaffolded Reading Experiences

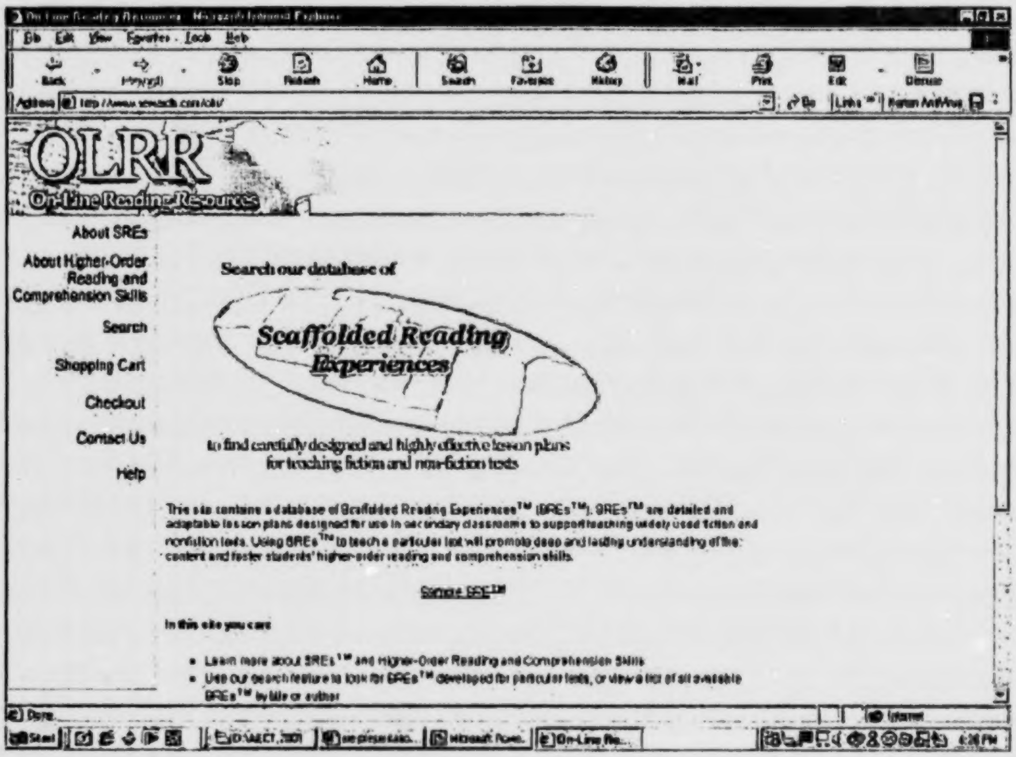
The scaffolded-reading-experience (Graves & Graves, 1994, Tierney & Readence, 2000; Watts & Rothenberg, 1997) instructional framework provides both lesson designers and lesson users with a flexible structure for text-specific lessons. This framework presents a set of options for creating coordinated sets of pre-, during-, and post-reading activities (Figure 1). While the framework is appropriate for various combinations of texts and purposes, the specific activities employed in any particular situation will differ greatly depending on the difficulty of the reading selection and the purposes for which students are reading.

Figure 1


Planning Phase
The Students
The Reading Selection
The Purpose(s) of the Reading
Implementation Phase
Prereading Activities
Reading Activities
Postreading Activities

Method Used in Constructing the Website and Scaffolded Reading Experiences The website (Figure 2) was constructed by professional design and development staff at Seward Learning Systems, Inc. (SLS), using standard web development tools and procedures. A designer, a subject-matter expert, a graphic artist, and a programmer worked as a team to develop the website. The scaffolded reading experiences (SREs) were created by two secondary teachers; university faculty members in literature, social studies, and reading education; and a research assistant. This team used the SRE instructional framework as a model for the instruction.

Figure 2


OLRR
On-Line Reading Resources
About SREs
About Higher-Order Reading and Comprehension Skills
Search
Shopping Cart
Checkout
Contact Us
Help
Sample SRE™

Search our database of

Scaffolded Reading Experiences

to find carefully designed and highly effective lesson plans for teaching fiction and non-fiction texts

This site contains a database of Scaffolded Reading Experiences™ (SREs™). SREs™ are detailed and adaptable lesson plans designed for use in secondary classrooms to support teaching widely used fiction and nonfiction texts. Using SREs™ to teach a particular text will promote deep and lasting understanding of the content and foster students' higher-order reading and comprehension skills.

In this site you can:

- Learn more about SREs™ and Higher-Order Reading and Comprehension Skills
- Use our search feature to look for SREs™ developed for particular texts, or view a list of all available SREs™ by title or author

Methods of Evaluating the Website and SREs

The website and the SREs themselves were evaluated by 10 high school English teachers and 10 high school social teachers. Half of these teachers were observed and interviewed by the project staff as they worked on the website and completed a written survey. The other half of the teachers completed only the written survey.

Two SREs were evaluated in high school classrooms. In one school, three 10th grade classes read and studied *The Great Gatsby* over a three-week period. Because of a last-minute school decision that different classes not receive different activities, all three classes used the SRE. All three classes also received pretests and posttests on knowledge about Gatsby and higher order thinking skills as well as a posttest in which they demonstrated higher order thinking with *Gatsby*.

In the other school, two 12th grade classes read and studied *Hamlet* over a three-week period. Here, we conducted a mini experiment, with one class receiving the SRE and the other class receiving the teacher's typical instruction. These two classes received pretests and posttests paralleling those given to the classes that read *Gatsby*.

Data Sources for Evaluating the Website and SREs

The data for evaluating the website and SREs were the field notes taken by the researchers as teacher-reviewers were exploring the website and SREs and the results of the written survey. The data for evaluating the effectiveness of the SREs were the results of the pretests and posttests administered to students who read *Gatsby* and those who read *Hamlet*.

Results with Respect to the Website and SREs Constructed

The website included five major pages:

- **About SREs** - approximately 1000 words in length. It explains what SREs are, the SRE framework, the possible components of an SRE, and the content and organization of each SRE.

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- **About Higher-Order Reading and Comprehension Skills** - approximately 1300 words in length. It includes a definition of higher order thinking (Resnick,1987), a description of analytical, creative, and practical thinking (Sternberg,1996) and a discussion of teaching for understanding (Perkins, 1998,1992). This section also includes a link to the Center for Critical Thinking (http://www.criticalthinking.org/default.html), which includes an extensive discussion of critical thinking and definitions and examples of the types of higher order thinking skills emphasized in the SREs
- **Search** - allows users to search the site by Author, Title, and Topic (all open fields), as well as by Type of Text (Fiction, Non-Fiction, Poetry, Drama), Ethnic Group Featured (Black, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic, White), and Grades (9-10, 11-12, 13-14).
- **Contact Us** -
- **Help**-

During the Phase I development the site was populated with the following six SREs:

- James Baldwin's "Sonny's Blues," (1948)
- William Faulkner's "A Rose for Emily," (1930)
- F. Scott Fitzgerald's *The Great Gatsby*, (1925)
- Russell Freedman's *Eleanor Roosevelt*, (1994)
- Shakespeare's *Hamlet*,(c. 1600)
- United Nations' *Universal Declaration of Human Rights*, (1948)

Each SRE was comprised of the following component:

- Introduction
- Table of Contents
- Objectives
- Higher Order Reading and Comprehension Skills Emphasized
- Chronological List of Activities
- Detailed Description of Activities
- Student Materials
- Resources

Thus, once a user is familiar with the organization of one SRE, she is familiar with the organization of all of them.

Evaluation Results

Observations and interviews with the 10 English teachers showed a very favorable attitude toward the site. The most valued features were (1) that teachers could modify the material, (2) the inclusion of student materials, and (3) the teacher resources, which included online resources. Teachers also commented that the search capabilities would be very useful once the website included a large number of SREs. Observations and interviews also revealed that the site generally functioned well.

The most consistent responses on the survey were that (1) shorter descriptions of the website would be desirable, (2) more graphics on both the website and the SREs would be desirable, and (3) having as many teacher resources as possible would be useful.

Tests of the 10th graders comprehension of *Gatsby* showed that on the pretest only 16 percent of the students had any knowledge about the novel and that no students could name any themes from the novel. On the posttest 96 percent of the students gave an acceptable or strong summary of the novel, and students named an average of 2 themes from the novel.

Tests of the 10th graders knowledge of higher order skills showed that on the pretest only 7 percent of the students had any knowledge about higher order thinking and no students could describe any of the three main types of higher order thinking. On the posttest, 84 percent of the students gave an acceptable or strong definition of higher order thinking, and students named an average of 2 of the three main types of higher order thinking. Additionally, on the posttest 72 percent of the students were able to use the higher order skills they had been taught to interpret a previously unread passage from the novel. (See Table 1.)

Pre and Post Test Means for The Great Gatsby SRE

Item	Pre-test	Post-test
Summarize the plot in three paragraphs or less.	0.0	2.3
Identify as many significant themes in the novel as you are familiar with.	0	1.7
Define Higher Level Thinking.	0	2.3
List the three main types of Higher Level Thinking.	0	1.7
Define Analytical Thinking.	.1	2.3
List three Analytical Thinking Skills.	0	1.9
Identify the section on pages 188-189 in which Nick makes these final comments by giving the beginning 4-5 words and the ending 4-5 words.	-	2.2
Select a sentence of phrase from that section that you find particularly informative about Gatsby. (2x)	-	3.7*
Explain what this sentence of phrase tells us about him. (2x)	-	2.8*

Table 1

Educational Importance of the Study

Everything we have learned thus far supports the feasibility of putting these online resources on the Web so that at least some of the time teachers can begin with quality basic lesson plans and spend their very limited time modifying, improving, and tailoring the lessons to their students rather than doing basic lesson design. Doing so should result in a huge saving of time and in better lessons.

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Web-Based Training and Corporate America

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Introduction

Advances in technology offer the possibility of new methods for delivering instruction. Learning via the Internet is being heralded by many as the new pedagogical model for training. Recent issues of training, computer, and management magazines all suggest that web-based training (WBT) is the best way to reach geographically dispersed employees quickly and at low costs. Some articles offer examples of companies that have successfully implemented WBT. However, the same articles that tout WBT as the next wave in the instructional technology revolution often fail to provide the reader with specific, instructionally sound steps for implementing WBT in a corporate setting.

Furthermore, many companies eager to embrace WBT have focused their attention on the features of the new technology. The trainers and/or instructional designers who fall into this trap expect WBT's features alone to provide effective instruction (Alexander, 1995). As a result, the advantages that WBT offers are often overshadowed by poor design and cumbersome navigation (Cohen & Rustad; 1998; Filipczak, 1997b; Henke, 1997; Strandberg, 1999). Learners are set adrift in cyberspace with little or no instruction.

The purpose of this paper is to explore the many unique characteristics of WBT and to discuss important issues related to the use of WBT in a corporate setting. These issues include the cost effectiveness considerations of using WBT, the design, implementation and delivery of WBT, and the impact that WBT has on both learners and trainers. Examples of how WBT is being used in American corporations will be introduced, too.

WBT

WBT refers to the communication of information over the World Wide Web (WWW) with the intent of providing instruction (Kurtus, 1997). WBT makes it possible for students, the instructor, the course content and, at times, professional groups and subject matter experts, to be in different locations at possibly different times and yet still be brought together through the use of on-line technology (Dede, 1996; Heckman & Owens, 1996; McIntrye, 1996; Saltzberg & Polyson, 1996; Smith, Tyler & Benscoter, 1999; Stenerson, 1998; Williams, 1998). WBT allows learners who cannot have face-to-face training to attend classes in their homes or offices through the use of the Internet or a company's intranet (Henke, 1997; Levin, Levin & Waddoups, 1999).

WBT uses Web technologies, such as, Web browsers including Microsoft Internet Explorer or Netscape Navigator, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP) protocols, and Hypertext Markup Language (HTML) as its programming language. HTML is a language that allows computers linked to the Internet to transfer information to one another, thus enabling the computer to retrieve all or just parts of the information located on a Web site (Hall, 1997; Polyson, Saltzberg & Godwin-Jones, 1996; Rutherford, 1996). By using HTML, the learner can explore additional resources in other web sites in the order and at the pace that he or she prefers. This experience, for most WBT learners, is similar to staying after class to talk with other students or the instructor.

WBT can be synchronous or asynchronous. Synchronous training is instantaneous and allows the instructor and learners to interact via the Web in "real-time" (Driscoll, 1998; Kruse & Keil, 2000). This can be accomplished through on-line discussions, real-time audio, videoconferencing, and application sharing where two or more people can work on the same file, such as a shared electronic whiteboard or a spreadsheet, simultaneously. In contrast, asynchronous training is not instantaneous; the learner logs on to the course to complete the lesson or post, receives and responds to messages at his or her own pace and at the time that is convenient to him or her(Bearman, 1997; Driscoll, 1998; Kruse & Keil, 2000). In using either type of WBT, it offers learners a higher degree of anonymity, as compared to face-to-face instruction. The anonymity enables the learner to interact with other learners in an environment free from bias or discriminations due to age, gender, economic status, or appearance differences.

In theory, any type of content can be presented via WBT (Beer, 2000; Driscoll, 1998). For example, WBT can be a good venue for presenting verbal information. WBT is also appropriate for delivering instruction related to concept and rule learning and problem solving skills. However, motor techniques and attitudinal skills are not well suited to WBT. This is due to the limitations of WBT in allowing the learner to practice the sequence involved in mastering the motor skills as well as procedures required for attitude or behavioral changes.

The Status of WBT in Corporate America

Many corporations now use some form of WBT to deliver training. According to a Fortune magazine survey, corporations in year 2000 spent approximately 20% of the $66 billion allocated for training annually on WBT (Gotschall, 2000). That percentage is expected to increase to 40% by the year 2003. In addition, a report provided by Masie in 1997 stated that in 1997 alone, 71 percent of major U.S. companies had an objective of using their intranets to pilot the delivery of corporate training presentations. Masie also reported that major software publishers, including IBM and Microsoft, are working on online learning and training products and services. Companies who published multimedia authoring tool companies like Macromedia and Allen Communications, are also building Web delivery capability into its products. Finally, Masie detailed that the majority of classroom-based training companies, such as CBT Systems and Gartner Group, has begun to establish online learning products (Anonymous, 1997).

Other corporate examples in using WBT include, PricewaterhouseCoopers, a consulting firm, is introducing a new learning technology called Continua. This technology allows employees to form virtual professional communities based on areas of interest, abilities, or client relations. Services such as peer dialogue, chat groups, online events, and online training are part of Continua (Koonce, 1998). In addition, in a recent study by Hall, it is reported that the Cisco Systems had the most pervasive e-learning implementation (Hall & LeCavalier, 2000). Cisco Systems offers some form of WBT in all 30 of its training organizations, with its major emphasis on sales training. However, Cisco itself notes that it uses WBT to deliver only 5% of its total training ("Learning on Demand").

Siemens Business Communications launched Siemens Virtual University (SVU) in 1997 and now offers more than 64 courses, from Local Area Networks and Wide Area Networks (LAN/WAN) technology to customer relations, to its 7,500 employees worldwide (Frieswick, 1999). Dell Computer Corporation aggressively pursued Web-based training as a solution to its employee education needs (Cone, 2000; Galagan, 2000). The company patterned its training after its business model, which emphasizes a direct-to-customer approach, with on-line training available 24 hours a day, 7 days a week. Dell's Vice President of Learning, John Cone, expects 90% of its courses to be delivered online by 2001. In 1998, Dow Chemical, headquartered in Midland, MI, began the process of converting its 700,000 employee-hours of industry-related training into Web-based training modules (Barron, 1999a). It anticipates that by the end of 2001, it will offer more than 60 courses via WBT, representing three-quarters of its industry-related training and an additional 300,000 hours of employee-development training.

In addition, IBM, Xerox, Siemens Business Communications and Eli Lilly Corporation employ a combination of individual assignments coupled with group discussions and projects in their WBT courses (Frieswick, 1999; Hibbard, 1998; "IBM builds its manager training," 2000; "Siemens saves $2000," 2000). Most of these courses are asynchronous. Only Chrysler, Herman Miller, Siemens Business Communications and Aetna offer real time learning to their employees (Barron, 1999a; "Herman Miller turns," 2000; Hibbard, 1998).

The topics most commonly taught via WBT are company-specific procedures and products. Southern California Edison, Siemens Business Communications, Xerox, Herman Miller, Dow Chemical, General Motors, Ford Motors, Cisco Systems, Eli Lilly, and Dell all use WBT to train employees on company-specific processes and products (Barrett & Lewis, 2000; Barron, 1999a; Beer, 2000; Frieswick, 1999; "Herman Miller turns," 2000; Hibbard, 1998; "Southern California Edison uses," 2000; "Smarter sales force," 2000). Technology-based courses, such as software programs or how to navigate the Internet, appear to be second to product and processes in course offerings. Dell, Microsoft, KPMG, Charles Schwab and Siemens Business Communications all offer technology-based courses to their employees (Balu, 2000; Dobbs, 2000b; Frieswick, 1999; Gotschall, 2000; Hall, 1997). Dell and Xerox also offer an orientation program to new employees via WBT (Beer, 2000; Cone, 2000) and Dell and IBM offer management courses via WBT (IBM builds its manager training, 2000).

Important Considerations of Using WBT in Corporations

A company must consider many factors when deciding whether or not the move to WBT would be cost effective. These factors are explained as follows.

Considerations of Cost Effectiveness

The first consideration is the cost that a company will spend on equipments, for delivering WBT courses. Normally, a Web server dedicated to supporting the materials can range from less than $5,000 to more than $100,000 (Beer, 2000; Hall, 1997) and in some cases, may also require an access license fee for each user (Wells, 1999). Companies may also need to pay for special "plug-in" software for special features, such as video, animation, and sound.

Companies also need to consider if they could afford allocating internal resources to create WBT courses. Normally, it would take between 100 – 200 hours to develop one hour of on-line instruction (Beer, 2000; Frieswick, 1999). For some companies, it may be more practical to contract with an outside vendor to develop the WBT courses. Most WBT design vendors charge anywhere from $7,000 to $50,000 per finished hour, depending on the course's complexity and use of multimedia plug-ins (Hall, 1997; Kruse & Keil, 2000). Consequently, whether the WBT is developed internally or externally, companies can spend thousands of dollars on the development stage. In addition to the development of WBT, maintaining the course is another issue. Maintenance costs often include revisions to the course and subsequent Web site maintenance (Beer, 2000; Hall, 1997; Kilby, 1997; Sanders, 1998). Web server maintenance and course upgrades can cost upwards of $500,000 per year.

Furthermore, how a WBT course will be used also affects a company's overall investment considerations. For example, a course that will be delivered once or twice, then abandoned, is not a good candidate for WBT (Kruse & Keil, 2000). Companies must consider the total number of learners who will be using the course and consider if the course can help reducing the amount of time the learners will be pulled out from their regular jobs.

However, while initial costs for WBT can run anywhere from $75,000 to $1.6 million (Barron, 1999a; Frieswick, 1999), Hall (1997) asserts that WBT "reduces the cost of training when compared to instructor-led training...primarily from a reduction in training time and the elimination of travel" (p. 108). Wells (1999) also emphasized that the initial costs to implement WBT are often offset by the long-term gain in employee productivity. By using WBT, companies can train a larger number of employees in a shorter time frame and at reduced costs when the materials are delivered via WBT (Barron, 1999a; Beer, 2000; Driscoll, 1998; Hall, 1997; Salopek, 1998; Wells, 1999).

For example, Hewlett Packard reports that WBT has reduced its new sales representative training from 20 weeks to eight days per year (Reinhardt, 1995). Hewlett Packard estimates saving $800,000 per year since its use of WBT. Before using the Web, Hewlett Packard must budget travel expenses both for its trainees and trainers, and must spend money on renting many convention centers in different cities for its sales training. Additional examples include, Aetna U.S. Healthcare estimates that it saved $3 million in travel and associated costs the first 18 months of its on-line training programs (Barron, 1999a). Steelcase, the largest office furniture manufacturer in the United States, has cut its training costs by 30% through the use of Web-based training ("Steelcase to save resources," 2000). Siemens Business Communications estimates that WBT has saved the company $4 million in travel costs alone (Frieswick, 1999) while IBM estimates that for every 1000 employees who use WBT, the company saves $500,000 in travel-associated costs (Kiser, 1999). MCI estimates that it realized a savings of $2.8 million in reduced travel, facility and labor costs in a 20-month period after the introduction of WBT (Neilson, Pasternack & Viscio, 2000). Rockwell Collins, a company that manufactures cockpit instruments, estimates that its newly-implemented WBT delivery system will save the company $14 million in three years in travel costs alone (Fister, 2000). Price Waterhouse realized an 86% cost savings using WBT over traditional classroom delivery (Hall, 1997). Dow Chemical estimates its $1.6 million WBT start-up costs are yielding a return of $4-$5 million annually (Barron, 1999a). And, Budget Rent-A-Car reduced its per employee cost from $2000 to $150 by placing its new employee training on the Web (Schaaf, 1997).

Considerations for Course Consistency and Delivery

Other factors that a company needs to consider when using WBT include, if the course content need to stay consistent over time, and if the course need to be delivered to the learners instantly. If the answers to these questions are "yes', WBT would be a good choice. WBT offers a higher level of content consistency that is difficult to be attained by human trainers. It can also prevent from a course being changed in remote offices. In other words, companies can use WBT to provide standardized training for all trainees regardless of different locations or instructors (Reinhardt, 1995). WBT can also provide instant distribution of the course content. The content of most WBT can be updated instantly, which is not possible with any other educational technologies. Technologies such as CD-ROMs, printed materials, floppy disks, videos, etc. must be mechanically reproduced, then mailed to the learners. With WBT materials, the designer simply has to send the course material or updates to the server and it will be available to the learner instantly (Driscoll, 1998; Hibbard, 1998; Kruse & Keil, 2000; Sanders, 1999; Staley, 1999).

Considerations of the Bandwidth Limitation

One of the frustrations related to the use of WBT in many corporations is the bandwidth limitation. Bandwidth determines how much information can be sent across the web and how fast it will be sent (Filipczak, 1997a; Hall, 1997; Schaaf, 1999a; Williams, 1998). Bandwidth problems translate to slow transmission and delayed response time for learners. Learners may become frustrated and bored when response time is very slow (Kiser, 1999; Kurtus, 1997).

Bandwidth can become an issue in one of three places: the originating computer, the "pipeline" over which the information is sent (in most cases, a telephone line), or the receiving computer. The most common bandwidth problems focus on the "pipeline." The "pipeline" refers to the data-carrying capacity of the computer-to-computer delivery channel. Common pipeline sizes range from relatively small 28.8 kilobytes per second (kbps) modems to optical fiber that can handle more than 10 gigabytes (gbps) per second. The problem of pipeline capacity arises when designers add data-intensive multimedia such as videos, complex audio, live transmissions, and animation to WBT programs (Bassi et al., 1998; Filipczak, 1997a; Kurtus, 1997; Schaaf, 1999a; Schaaf, 1997; Williams, 1998). The increasing use of the Internet also adds to bandwidth problems (Bassi et al., 1998; Schaaf, 1997). In 1996, bandwidth demand was approximately 200 trillion bits per day (bpd). This figure is expected to rise to 9,000 trillion bpd as early as 2001 and to 220,000 trillion by 2006, creating the potential for a network overload.

However, bandwidth problems can be lessened by creating separate, smaller programs that are executed within the primary application ("Applets," 2000: Beer, 2000). These smaller programs, called applets, are designed to be downloaded from the Web and launched by the primary application to support simulations and other media-intensive applications without adding to the size of the primary program. For example, the designer or programmer could create a master file that contains the rules and programming language necessary to run all simulations. The master file is then stored separately from smaller files that contain information specific to individual simulations. When a simulation is started, both files are used, but because they are stored separately, the download time is faster than when all the information is stored in one large file. Recently introduced Digital Subscriber Lines (DSL), satellite transmission systems and cable modems are becoming the alternatives to slow dial-up modems and bandwidth limitations (Bassi et al., 1998; Wiley, South, Basset, Nelson, Seawright, Peterson & Monson, 1999). These technologies offer users the ability to connect to the Web via standard telephone lines and receive data at rates considerably higher than 33.6 kbs. However, because DSL and cable modems use shared data pathways, increased use of these technologies eventually will result in reduced transmission speeds.

Considerations of Learners' Technical Skills

One of the more challenging obstacles when implementing WBT is the learner's lack of computer and/or Internet skills (Wulf, 1996, p. 54). For many organizations, this could mean additional technical training. In addition, employees with limited technical background and skills may feel apprehensive and confused. They may resist WBT training. Another possible drawback of using WBT is that the organization must rely on the individual to take initiative with his or her own WBT training (Wulf, 1996, p. 54). With WBT, although the company does not need to require an employee to be at a certain place at a particular time, however, the company must communicate with employees regarding when and where they will be trained and the level of participation.

Other Considerations

In addition to the above considerations, other considerations include security, the changing role of the trainer and the training department, and the impact of digital relationships. Security has become a growing concern. Since the Internet was originally designed as a private network for the military and for educational use, at that time, security was not a problem. With the growth of businesses on the net, the need for security has become greater with a public network (Keen, Mougayar, & Torregrossa, 1998).

There is also a concern regarding the skills and resources needed by the traditional trainer and training department if the organizations focus shifts to training via the Web. This is especially true since close to 50 percent of training departments are composed of classroom trainers (Appleton, 1998, p. 1). For example, the online instructor does not have the same type of control over a group of learners as they would in a typical classroom environment. The instructor must become more of a facilitator or moderator (Kearsley, 1997). Additionally, an online trainer in an environment that does not incorporate video is limited by not being able to see the learners. By seeing the learners, an instructor can gauge attention levels and comprehension of material. The trainer must ensure that the learners interact. They can do this by monitoring chat rooms, virtual white boards, etceteras (Snell, 1998).

The focus of training departments may become more centered on using Internet tools to develop, deliver, and monitor online training digitally, as opposed to developing and delivering classroom training.

Finally, there is concern regarding the impact of the prolonged exposure of learners and instructors to digital environments (Stone, 1996), as well as the formation of digital relationships versus the traditional development of relationships (Murphy, 1996). Some also feel that with the loss of face-to-face interaction, behavioral, gestures, and tonal cues may cause misunderstanding (Pennell, 1996).

Organizational Implications in Using WBT

The first implication is related to the function and skills of trainers or instructional designers of a company. While developing WBT courses, corporate trainers or instructional designers need to be proficient in skills that are not normally associated with classroom or face-to face instruction design (Alexander, 1995; Beer, 2000; Curtin, 1997; Dobbs, 2000b; Hall & LeCavalier, 2000; Horton, 2000). They now need to possess a thorough understanding of HTML, computers, networking, and Internet protocols in order to incorporate materials that are Web-compatible. Clearly, the Web is a largely visual medium; it would be helpful for corporate trainers to be proficient in graphic design and layout. It would be also helpful for the trainers or designers to have an artistic perspective and a basic understanding of ratio aspects.

The second implication concerns the relationship between the Training department and the Information Technology (IT) department. Clearly, as a company moves to WBT, the Training Department needs technical support from the IT department (Curtin, 1997; Driscoll, 1998; Filipczak, 1997a; Hall & LeCavalier, 2000; Kiser, 1999). The two departments now must work together to ensure that WBT does not create a drain on the company's network, servers and IT Help Desk.

One result of this collaboration will be that trainers and/or the instructional designers instructional designers will have a better understanding of the technology used for WBT, and the IT professionals will benefit from an increased understanding of instructional design process.

Finally, the last implication is about merging working and learning among employees. As WBT becomes more commonplace in organizations, companies will find more ways to integrate it into employees' everyday work lives (Beer, 2000; Cone, 2000; Driscoll, 1998; Ryan, Neece & Meyer, 2000). Employees will have WBT available as a means of quick reference at their desktops. They will be able to access a WBT course, or a small piece of it, to seek the information they need. Employees will come to expect instantaneous information and to access to subject matter experts as a way of doing business. Employees will eventually become so used to the process of receiving information "just-in-time" without even realizing that they are learning while working.

Reload buttons should be available to make the learner's navigation through the course easier (Kruse & Keil, 2000). In addition, page transitions should be simple and speedy to avoid long download times and subsequent learner frustration (Curtin, 1997; Williams, 1998). Every page should include a link to the course's home page to allow a "lost" learner to find his or her way back to the course easily (Nielsen, 1996). Multimedia should be avoided because of download time constraints, unless it is critical to the learning process (Beer, 2000; Clark & Lyons, 1999).

Finally, storyboards for each WBT module are strongly recommended for designing and revising purposes (Driscoll, 1998; Hall, 1997; Kruse & Keil, 2000; Ward, 1998). Storyboards are visual representation of the information that will be included on the screen. One storyboard should be created for each screen, and it should include thumbnail sketches of all onscreen visuals and the corresponding text. Storyboards should include identifying information, such as the course title, the date, the version or draft number, and the page number. It will also specify the names of the files (audio, video, graphic) to be used, file numbering schemes, programming notes, and branching instructions.

Conclusion

WBT is time and location independent and thus enabling companies to train their widely dispersed employees without incurring exorbitant travel cost. Employees are also allowed to have a higher level of flexibility while taking a WBT course. However, technical and design issues present obstacles to the effective use of WBT in many corporations. It is imperative that WBT is grounded in learning theories and instructional design principles. Effective WBT must also engage employees and provides them with opportunities to apply the gained knowledge and skills back to their jobs.

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Facilitating self-direction in computer conferencing

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Introduction

Computer conferencing, which entails "conducting a conference between two or more participants at different sites by using computer networks to transmit any combination of text, static pictures, audio and/or motion video" (Palloff & Pratt, 1999, p.189-190) originally started as a supplementary instructional mode in a conventional face-to-face class. Recently however, computer conferencing is sometimes used as a primary mode of instruction and it is even considered an alternative instructional method with high interest. This trend naturally leads to the question of its educational significance.

There are extensive studies about computer conferencing despite short history and most studies explain or enumerate its characteristics and advantages. However, most publications are theoretical discussions without a concrete case. Recently, a few studies describe what typically happens in an online course (e.g., Eastmond, 1995; McDonald, 1998). Thus, this study describes what really happens in an online course to test the educational value of computer conferencing. Especially, this study focuses on self-direction among many advantages of computer conferencing because it is a usual goal of distance education.

Computer conferencing

Many studies explain the characteristics of computer conferencing (e.g., Feenberg, 1989; Harasim, 1989, 1990; Kaye, 1989; Mason & Kaye, 1989). The major characteristics of computer conferencing include many-to-many communication, place and time independence, text-based communication, and high interactivity. Computer conferencing makes group communication possible that was impossible in traditional distance education modes. Computer conferencing synthesizes advantages of face-to-face and distance education in that all participants interact with each other and this interaction is time and place independent. In addition, instructors manage learning programs and courses that are adaptive and responsive to the needs of individual learners, by ongoing communication. Consequently, computer conferencing is a paradox in distance education by eliminating psychological separation between learner and instructor through interaction (Saba, 1988).

Interaction

Distance education can be differently defined according to its major focus. Most distance educators, however, agree that distance education assumes a physical separation between instructor and learner (e.g., Holmberg, 1995; Keegan, 1996). As a result, learners engage in learning, while considering convenient times and places instead of scheduled ones. Thus, learners have independence in time and place. Traditional distance education modes, however, are based on one-way communication in which the teacher controls learning. As a result, learners become more passive in the learning process than in a face-to-face class considering that they can't share their opinions. At the same time, learners experience isolation because of psychological distance resulting from lack of dialogue between learner and instructor or among learners. Consequently, learners do not have independence in controlling and directing their learning process. Especially, considering that learning is a transactional process, which entails exchanging ideas, thoughts, and feelings among people (Palloff & Pratt, 1999), the absence of interaction has been a great weakness, even though early distance education served the solitary learner.

Therefore, distance educators have searched for new educational methods to increase dialogue among participants for effective learning. The history of American distance education supports the importance of interaction in distance education. That is, continuous efforts providing learners with independence in their learning led to interest in interaction among participants during the learning process. Thus, the concept of interaction and its role in distance education have been important topics in distance education research (Moore, 1995).

Why is interaction important in distance education? Interaction in distance education is closely related to individualization in learning. That is, when learners actively interact with instructors or peers, they can address their consistently changing needs. This can lead to suitable learning for each person. This provides learners with independence in the learning process as well. Therefore, interaction is very important in distance education and it explains why many people undoubtedly welcome computer conferencing characterized by high interaction.

Self-direction

For a long time, adult educators have emphasized the learner's autonomy or independence in self-directed learning. It leads to the understanding of self-directed learning in isolation excluding external assistance or interaction. The self-directed learner, however, is not, in Moore's word, "an intellectual Robinson Crusoe, castaway and shut off in self-sufficiency" (1973, p.669, cited in Brookfield, 1986). In this context, many adult educators argue the importance of interaction related to self-direction. Brookfield (1985) states the importance of external sources of assistance regarding self-direction. Garrison (1987) supports the idea that self-direction is highly dependent upon interaction and collaboration between a learner and facilitator. Candy (1991) suggests a new view defining self-direction as a product of interaction between the person and the environments. With the criticism of previous studies focusing on external control in the learning process, recently the definitions and conceptualizations have moved away from equating self-directed learning with sociologically independent learning to an interactive concept.

Garrison's model of self-directed learning

This study followed current research trend focused on multidimensional and interactive aspect of self-direction. In this context, Garrison's comprehensive model (1997) and his concept of control construct (1993) contributed to developing the conceptual framework. According to Garrison, self-directed learning is comprised of self-management, self-monitoring, and motivation and each dimension is very closely connected. Self-management means "decision of learning objectives and activities, and the management of learning resources and support" (p.22). It entails the learner's external control over the learning process. However, Garrison explains the concept of self-management based on collaborative relationships between teacher and learner instead of independence. Thus, self-management does not mean simply learner's external control. That is, self-management (control) consists of three variables, proficiency, resources, and interdependence (Garrison, 1993). Proficiency refers to "the abilities and skills of the teacher and student related to construction of knowledge". Resources refer to "diverse support from teacher and assistance from learner in educational contexts". Interdependence means "teacher responsibilities (institutional or subject norms) as well as learner choice (freedom)" (p.31-33). That is, the learner has independence in transactions with the teacher. Consequently, the balance of each variable influences the extent of control. Control is dynamic by existing in the circle of communication between teacher, learner, and curriculum as well.

Self-monitoring means the internal aspect of self-direction by referring to construction of meaning. It assumes that the learner has responsibility to construct knowledge. This is related to the extent of the learner's cognitive ability and thus it leads to differences in the degree of self-direction. Self-monitoring is a metacognitive process because it needs critical reflection as well. Self-monitoring includes collaborative confirmation. That is, constructed knowledge based on the learner's cognitive ability is confirmed by others in the learning process. Thus, self-monitoring depends on shared control based on transactions between learner and teacher.

Motivation refers to "perception and anticipation related to learning goals at the beginning of learning and mediates between control and responsibility during the learning process" (p.28). Motivation includes entering and task motivation. Entering motivation is related to the decision to participate at the beginning. Task motivation is related to the will to continue the task during the process.

Research objectives

This study explored the extent to which computer conferencing contributes to facilitating self-direction by describing concrete activities. This study focused on interaction among participants related to self-direction because it is very characteristic of computer conferencing. At the same time, it is necessary to study self-direction in group learning rather than individual study.

This study had the following objectives. First, this study explored the possibility that computer conferencing can contribute to facilitating self-direction by describing interaction patterns in an online course. Second, this study sought evidence that learners are self-directed in an online course by describing concrete self-directed activities that occurred in computer conferencing. Third, this study showed the extent of self-direction students have in this course. Finally, this study focused on interaction to explain how learners are self-directed in an online course.

Conceptual framework

This study adapted Garrison's model (1997) considering the characteristics of data and research questions to develop conceptual framework. Consequently, in this study self-direction consists of three dimensions (control, critical reflection, responsibility) and interaction influences self-direction. Self-direction means both overall decision and management related to learning and knowledge construction. Control means the opportunity and the ability related to making decisions in the learning process, capability to manage resources, and cognitive ability to construct knowledge. It consists of interdependence, proficiency, and resources. Critical reflection means the process of constructing personal meaning. Responsibility means learner's active attitude to learn.

Case description

A graduate level course taught adult education via computer conferencing in the Spring of 1998 at a midwestern university was chosen as the case for this study. This course consisted of twenty-one students. Among them were, fifteen females and six males, fifteen majored in adult education and six other majored, seven experienced people of FirstClass®, used as computer conferencing software in this course, fourteen nonexperienced. One female instructor taught this course. Students had one face-to-face meeting at the beginning of course to receive information related to course and to practice FirstClass®. After the initial face-to-face meeting, all discussions depended almost entirely on asynchronous communication. The instructor separated students into four groups considering previous FirstClass® experience, gender, distance to campus, department, and similar name. The instructor posted an overview including readings, brief summary of content, questions and activities for each Week folder. Each group decided on a weekly moderator who read weekly messages posted until Thursday midnight and summarized the discussion. The moderator posted a summary for each week in a Week folder so all four groups has a chance to read the summaries of all the groups' discussion of the past week. Students proceeded group project as well as individual learning activity according to group member's interest.

Methodology

This study analyzed the content of transcripts of participants to explore research questions. In this study, weeks 3, 8, and 13 were selected based on time period, the number of messages, the progress of group projects, and the topic of the week. The total number of messages during weeks 3, 8, 13 was 1,333. It was necessary to code total messages for data analysis. In this study, speech segment created by Henri and Rigault (1996) was used as a single unit for data analysis. After the coding work was finished, inter-rater reliabilities were assessed to decide whether several raters had a high degree of consistency. Cohen's*k* reliabilities for interaction type, function, and self-direction were .95, .90, and .89, respectively.

Results and discussion

Objective #1: Interaction patterns

The degree of students' participation shows whether this online course is learner-centered or teacher-centered. During weeks 3, 8, and 13, participants posted 1,333 messages. Students posted 1,159 and instructor posted 174 messages. In addition, 21 students generated 1,159 messages during 3 weeks, averaging approximately 19 messages/person/week. Related to interaction type, students provided 94% of initiation. This result was in accord with the previous studies (Eastmond, 1995; Garrison, 1987; Mason, 1988; Seaton, 1993), insisting that an online course should be learner-centered.

Objective #2: Self-Directed activities

This study categorized self-directed activities which occurred in this online course based on three dimensions of self-direction: control, critical reflection, and responsibility. Selective response, autonomous decision, providing norms, and negotiation were classified as activities of interdependence, one component of control. Interpretation, definition, judgment, and challenging or questioning were classified as activities of proficiency, one component of control. Providing help, sharing information, providing social support, and confirmation were classified as activities regarding resources, one component of control. Revision, correction, finding misconceptions, meeting new perspectives, self-reflection, connecting with previous knowledge, experience, current situation, and knowledge construction were classified as activities of critical reflection. Asking for help, information, clarification, confirmation, and notification of nonparticipation were classified as activities of responsibility.

Self-directed activities classified in this study confirmed the current conclusion that self-direction is multidimensional and is based on interaction. That is, self-directed activities confirmed the conclusion that learners had self-direction through ongoing interaction. After all, students had self-direction in learning in the process of establishing shared agreement, collective knowledge, and shared control. Self-directed activities also reflected a characteristic of computer conferencing. That is, asynchronous communication and text-based communication influenced self-directed activities. For example, students interacted with each other through written messages because computer conferencing is based on text-based communication. Thus, selective response was a strategy for controlling learning content. At the same time, this was a very important tool related to control considering that this course was response-centered. In addition, the self-directed activities that were found reflected the characteristics of group learning based on interdependence and interaction. Thus, these activities had limited generalization to face-to-face courses and individual learning. As an extension of this study, the comparisons between face-to-face and online course and between individual and group learning can contribute to explaining how students are self-directed in virtual group learning.

Objective #3: Extent of self-direction

There were 1,852 speech segments related to self-direction which was 70% of the total speech segments. This means that this course had a relatively high degree of self-direction. Within the three components of self-direction, the number of speech segments classified as control was 1,442, critical reflection was 214, and responsibility was 196. Thus, students' self-direction in this online course appeared to be mainly related to control. The number of speech segments which were classified as interdependence was 143, proficiency was 506, and resources was 793 among the three components of control. This showed that students participated in knowledge construction during the course and they received diverse resources from instructor and peers. The high percentage classified as resources implies that interaction among participants contributed to developing self-direction.

Objective #4: Mechanism of facilitating self-direction

High percentage of resources related to self-direction supports the importance of interaction. Previous studies assumed interaction influences self-direction without evidence. The researcher paid attention to message threads made by participants to examine the relationships between self-direction and interaction. Students sometimes opposed or questioned previously taken for granted assumptions and this engendered other's perspective transformation. Students experienced critical reflection through these processes. Students constructed knowledge and the instructor or peers confirmed it. Thus, interaction connected control with critical reflection. Interaction influenced the relationship between responsibility and control as well. Students asked for help when they experienced technical problems or needed more information and saw this as their responsibility. An instructor or peers provided students with diverse resources. Interaction connected responsibility with critical reflection. Students sometimes did not have a clear understanding because of an ambiguous use of a word. Students asked for more clarification to the author of a problematic message. The author automatically had an opportunity to think again about his or her own message and revise it. This helped critical reflection. After all, three components of self-direction: control, critical reflection, and responsibility are connected each other through learner-learner interaction and learner-instructor interaction.

The mechanism students can be self-directed through interaction in an online course leads to the conclusion that an instructor and peers play important roles related to facilitating self-direction. An instructor and peers influenced student's decision process. Instructor participated in this course one of participants and she collaboratively managed course with students. Related to collaborative course management, the degree of a structure of course is very important because it influences the latitude for student's choice. This course was managed according to a syllabus made by the instructor before course began and weekly overviews during the course. However, even though the instructor decided the overall structure, it could be changed according to students' response. Actually, students sometimes challenged to a rule or decision made by instructor. This resulted in a change of the teacher's structure based on shared agreement. The course structure was maintained not only by interaction between instructor and students but also by negotiation among students. Students sometimes solved problems themselves based on collaborative decisions. The instructor provided students with minimal guidelines and facilitated their learning as not a lecturer but as a facilitator in democratic environment. Thus, students frequently negotiated with the instructor and peers for effective course management and have shared control as a result.

Students built collective knowledge through interaction. An instructor and peers made learner challenge previous or current knowledge and helped to build new knowledge. The role of instructor and peers did not end only with challenging. The instructor and peers confirmed constructed knowledge. This helped the learner to make his or her knowledge meaningful under this process. In addition, the instructor and peers provided learner with cognitive help related to knowledge construction. When students needed supplementary explanations, they rephrased ambiguous terms and provided suitable examples. Both instructor and peers contributed to building learning community in virtual learning environment.

All participants shared diverse resources in a flexible time schedule. Resources that participants shared were not related to only content and technical aspects. Students shared personal experience. Social support from the instructor and peers helped learner to overcome psychological anxiety and isolation related to using computer conferencing. Consequently, students share same feeling and experience through interaction and feel their learning community.

Implications for practice

This study confirmed that students are self-directed in an online course, as indicated by concrete self-directed activities and their extent. Furthermore, this study explained how students are self-directed in an online course by focusing on instructor and peer's roles. Major findings have several implications for practitioners.

First, this study showed that a low level of structure is related to self-direction. The instructor did not force students to follow fixed procedures but modified the structure to be responsive to learners' needs. Students had room for expressing their needs and making decisions in this environment and self-direction was a result. Thus, it is desirable for students to have an opportunity to choose or decide related to their learning. Instructors should modify traditional authoritative roles and interact with participants in order to create such an environment.

Second, students' self-direction appeared most in the control dimension. Students were self-directed regarding proficiency and resources. This supports the important role of interaction in facilitating self-direction. That is, students collaboratively construct knowledge and frequent feedback from instructor and peers helps students to achieve content and technical mastery. Therefore, instructors and course designers should pay attention to how to provide students with frequent feedback.

Finally, this study confirmed that the learning environment is very important in developing self-direction. Students experienced psychological anxiety related to a new learning environment and missed features of a traditional face-to-face course. However, students found that they studied not alone but together through frequent interaction. Social support from instructor and peers and sharing personal experience made students feel comfortable in the new environment. Thus, instructors should make an effort to develop a comfortable learning environment to facilitating self-direction, for example through informal discussion. A comfortable learning environment will help encourage lurkers to become participants.

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An Analysis of Faculty Concerns Regarding Distance Education at Canton College

Molly Mott
Suny Canton

PART A: INTRODUCTION

Nanotechnology, the new frontier of microscopic technology, is shaking up the scientific world with the same "promise and fear" that the atomic theory first shook the world during the 1950's (*USA Today*, 24 October 2000). The building of mechanical and information machines on a nanometer scale (one-billionth of a meter) has attracted both its supporters and detractors. Advocates point to the promise of one-day sending cancer-detecting microscopic machines into the human body to deliver cancer- fighting drugs. Opponents, on the other hand, warn that terrorists may someday use the technology to create nanosize mechanical germs for release in terrorist's attacks. Should the scientific community embrace or reject this new technology? What stirs its debate? Is it misunderstanding or legitimate concerns regarding its use or abuse?

New technology, whether it is new technology in the scientific field or new technology in the educational field, spurs debate. In a recent article entitled "College Online: Rethinking How to Learn," published in the *Watertown Times*, 10 September 2000, distance learning is viewed as a revolutionary force that "looms large on the education landscape." As established universities race ahead with online programs, faculty members continually debate its virtues and uses. To many educators distance education is an innovative and creative instructional medium. For others, it is the commercialism of education, an educational format plagued by pedagogical uncertainties. Many college campuses across the country are currently engaged in its controversy, and the State University of Canton College is no exception. With its unique blend of liberal arts and technology education, Canton College includes faculty that both support and deny the merits of distance education. No where is this more evident than at faculty meetings where heated debates often erupt between a skeptical liberal arts faction and a so-called "willing" technology and science faction. Such divergent educational viewpoints in one institution, I believe, provide a rich environment in order to research faculty concerns related to distance education.

Overview of distance education

"Fernunterricht" or "Tele-enseignement" are both European terms for one of the fastest growing and most controversial segments of higher education, distance education. While the terms distance education and distance learning are often used interchangeably, each word has a distinct meaning. Distance education describes the organizational framework and process of providing education at a distance. In this framework, teachers and students are separated by physical distance and technology is used to bridge the instructional delivery (Moore 1989). Distance learning, on the other hand, identifies the intended instructional outcomes and depicts the learning that takes place at a distance. Every effort will be made in this paper to adhere to these specific definitions.

Historical perspective

Most people assume that distance education is a relatively new phenomenon. However, the growth in the area of distance education is best characterized as evolutionary rather than revolutionary (Willis 1994). Learning at a distance has been going on for years; it is the mode of delivery that has changed. Today, audio, video and computer technologies are more common methods of delivery than the historical correspondence courses of years ago.

Traditionally, distance education students have been adults, studying part-time and geographically distanced from the enrolled campus. Access to continuing and higher education has typically been the primary motivating factor in students enrolling in distance education courses. Recent evidence suggests that this demographic trend is changing. Younger, local students with full-time course loads that combine distance education courses with on-campus courses now comprise new student populations (Wallace 1996). While students of the past sought access to continuing and higher education; students of today are attracted to distance education because of the ability gain control over the time, place and pace of their learning. Consider the following article entitled, "SUNY Online Classes Giving More People Access to Higher Ed," appearing in the *Watertown Times*, 20 October 2000:

> Ms. Walker is a full-time student at Jefferson Community College. Four days a week she commutes to take four night classes. There were not enough hours in her schedule to take another class, so he decided to take one of her classes online. "This course is working wonderful for me as a mother because I can do it at home. I wouldn't be able to take a fifth class if it wasn't online."

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Delivery Technologies

Distance education involves two main delivery methods: synchronous (interactive video) and asynchronous (online or web-based). Synchronous learning is the simultaneous participation of student and instructor. Instructional delivery is at the same time, but at different locations. For example, various campuses in the State University of New York (SUNY) are linked to one another via a telecommunications line. This telecommunication line transmits live video. Thus, a SUNY Canton site may be transmitting a "live" course via television to another SUNY campus, allowing live group discussion between sites. In order to accommodate synchronous delivery, special distance learning classrooms must be constructed. These classrooms are equipped with television monitors, ceiling microphones, sound proof walls, as well as computer and other technological equipment necessary to conduct interactive classrooms. Such classrooms can be expensive. They require a significant initial capital investment, and funding for on-going equipment maintenance and support.

Asynchronous instruction, on the other hand, does not require that student and instructor be located in the same location at the same time. Instructional delivery is at different times and different locations. Examples of asynchronous delivery include email, listservs, and web-based or online instruction. Asynchronous instruction can occur anytime, anyplace, as long as the student has a computer and access to the course through a registration process. Students are able to choose their own instructional time frame, and studying lectures and participating in their class according to their own schedule. The primary advantage of asynchronous learning is flexibility; students choose the location and the time for learning. However, there are disadvantages to online instruction. These include considerable email-based written exchange and online development training needs of the faculty. Both forms of instructional delivery will be included under the general term distance education for purposes here.

Trends in distance education

According to the U.S. Department of Education, National Center for Education Statistics (1999): Nearly 80% of public, four-year institutions and over 60% of public, two-year institutions offered distance education courses in the 1997-1998 academic year. Overall, U.S. higher education institutions reported 1, 661,100 students are enrolled in distance education courses. The most popular delivery technologies used were asynchronous Internet instruction (58%), two-way interactive video (54%), and one-way pre recorded video (47%). This year the State University of New York (SUNY) system itself enrolled more than 20,000 students in distance learning courses, 7,000 more than last year. Five years ago only 119 students were taking distance learning courses. It is estimated that in the next two years 85 percent of American colleges will be offering online courses to over two million students (Moore 2000).

History of distance education at Canton College

Canton College has been using both asynchronous and synchronous methods of distance learning since 1997. The college uses a 2-way audio/visual conferencing system, interactive television, to send and receive classes to and from other state colleges. More than 2,000 students have participated in course offerings that have included Companion Animal Behavior, Criminal Law, Business Communications and Wine Tasting. Recently, the college has begun an ambitious project with China utilizing interactive video to broadcast courses in English Conversation to a class of twenty Beijing high school students. Canton also participates in the SUNY Learning Network, an umbrella organization offering online courses at forty-five SUNY institutions (see Appendix A).

PART B: PURPOSE AND OUTLINE OF PAPER

It is my intent to study distance education at the State University of New York at Canton College, juxtaposing viewpoints from a humanities and liberal arts perspective with those of a science, medical and technical perspective. It is hoped that such an analysis will provide an interdisciplinary context for understanding faculty concerns and a framework for applying current educational research to specific faculty issues.

Why this thesis?

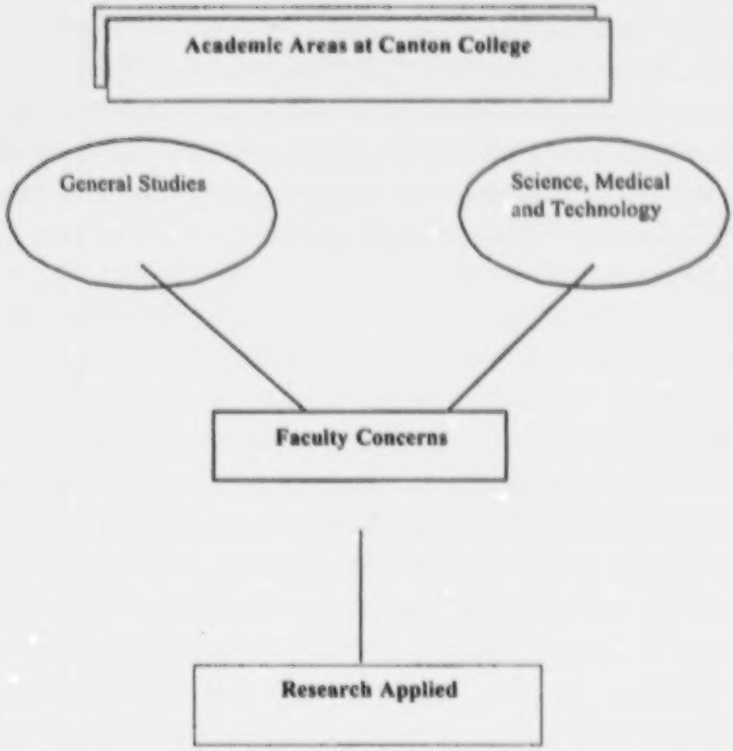
I developed this thesis as a result of witnessing the many skirmishes and debates among fellow faculty members over the use and value of distance education. I listened as faculty expressed their concerns over distance education and deliberated its merits. While many of my colleagues expressed a substantial amount of opinion, I heard little research applied to such concerns. If faculty members believe that student learning is compromised by distance, I wanted to know whether or not educational research supports this claim. I was also curious about the pattern of opinion I observed at the college. It seemed that those faculty representing the liberal arts, writing and humanities curricula were quite vocal against distance education, while those members of the science, medical and technical aspect of the campus appeared either nonaligned or willing to explore the use of distance education in their courses. I wondered if the various schools of education at Canton College shared any common ground of concerns, or did any one faction harbor specific concerns while others did not. More importantly, could I explore the merit of these issues through the use of educational research? The answers to these questions form the basis of my paper.

Biases Acknowledged

I think it important to acknowledge my personal background and biases regarding distance education. I have been instructing one course via three different instructional modalities, two of which are taught in a distance learning format. In the fall semester, I teach the course on campus, while in the spring and I teach the course via interactive video and the Internet. As a result of this experience, I am keenly aware of issues surrounding distance education, both political as well as pedagogical, and understand the concerns that many faculty members have on campus regarding its use in higher education. However, I feel such experience has only made me more willing to explore research into this area of education. I believe that my experience with distance education will not inhibit the execution of my thesis, rather, I hope it will provide a knowledgeable context to record faculty concerns and a dispassionate vehicle for applying educational research to these concerns.

How this project was conducted

The intent of this project was not to engage in rigorous scientific study, but rather, to explore general perceptions regarding distance education and to provide a cross-sectional representation of faculty concerns at Canton College. I divided the academic schools at Canton College into two fields of interest: general studies (sociology, psychology and English) and science, health and technology. Three representatives from each respective school were then asked to participate in personal interviews. Faculty members with varying degrees and experience in distance education were selected. An honest effort was made to objectively choose faculty without a reference to their beliefs; however, I must acknowledge that I did choose those faculty I knew to be abundant in their opinions so as to obtain as much data as possible. Each faculty member during the interview was asked to discuss particular issues or concerns that they had related to distance education and to prioritize such issues. Educational research, including published formal studies and journal reports, was then applied to specific faculty concerns regarding distance education.


Academic Areas at Canton College
General Studies
Science, Medical and Technology
Faculty Concerns
Research Applied

PART C: FACULTY OPINIONS ON DISTANCE EDUCATION

Overview of Faculty Outlook

Currently, one in 10 higher education National Education Association (NEA) members teaches a distance education course (NEA, 2000, 4). The Association's June 2000 report, "A Survey of Traditional and Distance Learning Higher Education Members", provides statistical information regarding faculty outlook towards distance education. Among the findings:

- 51% of traditional faculty hold positive feelings toward distance education courses, compared to 22% who hold negative feelings. A significant proportion, (28%), of traditional faculty remain undecided.
- Among distance learning faculty, 72% hold positive feelings compared to only 14 % who hold negative feelings.

United University Professions (UUP), a union comprising 24,000 academic and professional faculty from 29 campuses, conducted a similar poll. Members were asked about the issue of distance learning within the State University of New York (SUNY) system. Published results from a poll of 500 UUP members indicated that members were overwhelmingly receptive to the use of distance learning but expressed a strong skepticism about its quality, effectiveness and impact on their profession (*Scheurman 2000, 11*):

- 72 percent of respondents believe distance learning will mean more work for the same pay.
- 73 percent of respondents worry about their intellectual property rights.

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- 68 percent of respondents do not believe that distance learning courses provide the same quality as traditional courses.

Faculty Outlook at Canton College

> The debate between the new and the old, technology and traditional, has been going on since the days of Plato and Socrates. Socrates, versed in the traditional art of oral education, refuted the written expression, the new educational format of his student, Plato. Such an analogy parallels the resistance of traditional pedagogy to new educational delivery, distance education (Horn 2000).

Ultimately, the success of any distance education program rests with the faculty. In general, Canton College faculty expressed concerns ranging from pedagogical and student achievement issues, to those of assessment, compensation and workload. Faculty seemed most concerned with issues of quality learning and less concerned with issues of copyright and compensation. Although issues of workload, compensation etc. were important to Canton faculty, they seemed less important than the issues of quality instruction and student learning. Interestingly, this observation somewhat parallels the 1999 NEA findings in which polled faculty reported that they evaluated distance education primarily on quality of education and secondarily on more traditional union considerations (NEA, 2000, 35).

Interview Results

Interview results reflecting individual faculty concerns regarding distance education and comments related to those concerns, can be found in Appendix B.

PART D: RESEARCH APPLIED TO FACULTY CONCERNS

Concern: Student Achievement

Of primary concern to the faculty at Canton College is the question of student learning. Do distant students learn as much as students receiving traditional face-to-face instruction? Faculty members at Canton College were passionate in their belief that student achievement is significantly lower in a distance education than it is in traditional instruction. Many faculty members argued that students do not learn as much, as well, or as effectively in a distance learning format as they do in a traditional learning format.

However, hundreds of general media comparison studies conducted over the last forty years have demonstrated no significant difference in achievement levels between distant and traditional learners (Cyrs 1997,4). Most of this research has generally been in the area of instructional television. Studies by Crow (1977) "found that there was no significant difference in student achievement regardless of the proximity of the instructor." Dubin and Travaggia's (1968) longitudinal study demonstrated "clearly and unequivocally that there is no measurable difference among truly distinctive methods of college instruction when evaluated by student performance." Whittington (1989), in his review of research literature on distance education concluded that " findings of equivalent student achievement hold even when rigorous methodological research standards are applied." According to DeLoughry (1998), students learn as much and as well in computer-mediated instruction as they do in traditional educational settings. DeLoughry cites a study conducted by researchers at the New Jersey Institute of Technology to support his claim:

> Researchers tested the effectiveness of online instruction by studying five courses in which a total of 98 students were enrolled for classroom-based instruction and 80 others were instructed online. A comparison of the average test and course grades for the two groups in each course turned up no statistically significant differences between the experimental and control groups.

Research has also demonstrated in general that students learn at a distance as well and as effectively as students in traditional face-to-face classrooms (Cyrs 1997,4). The following excerpt from Clark (1983) summarizes the influences of media on student learning:

> Media comparison studies clearly suggest that media do not influence learning under any conditions. The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition. Basically, the choice of vehicle might influence the cost or extent of distributing instruction, but only the content of the vehicle can influence achievement (Clark

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While comparison studies may document education outcomes, they omit several key concepts regarding student learning. First, comparison studies do little to address learner experience, i.e., student satisfaction levels and student attitudes. In essence, they ignore the role of social presence in student learning. Recent educational research on distance learning has recognized this deficiency and is now shifting the focus from comparative studies to theory –based studies. Theory-based studies explore the social aspects of student learning. Fahab (2000) outlines the following research findings:

- Fulford and Zhang (1993) evaluated learner perception of interaction in instruction. Their research findings concluded that overall interaction dynamics may have a stronger impact on learners' satisfaction than strictly personal participation.

- McDonald and Gibson (1998) explored interpersonal interaction and group development in an asynchronous distance education environment. Their studies concluded that students are capable of resolving interpersonal issues and form organized, cohesive working groups.

- Gunawardena (1995, p. 164) studied the social presence theory for community building in computer mediated conferencing. She concluded "in spite of the low social context cues of the medium, student perceptions of the social and human qualities of the medium depends on the social presence created by the instructors and the online community."

- Tsui and Ki (1996) studied school factors affecting computer mediated instruction. Their study revealed that communication among students was bilateral, as students often hesitated to enter a dialog started by two other students.

Recent studies by Kanuka and Anderson (1998) also address the social process of learning in a distance education environment. After studying the interaction among participants in a distance education forum, both researchers determined that a "significant time was engaged in social interchange followed occasionally by social discord. Social discord served as a catalyst to the knowledge construction process."

Secondly, although learning outcomes and student achievement levels are documented in media comparison studies, "quality outcomes" are not. What are quality outcomes? Do they simply imply satisfied learners or are they outcomes that demonstrate that students have achieved cognitive skills not previously possessed prior to their distance learning experience? Comparison studies would do better to qualify outcomes in their analysis.

Thirdly, although these comparison studies have addressed distance education as a whole, they have yet to explore the intricacies and particular features of each of the various distance learning modalities. Little attention has been given to specific media features and how such features contribute to learner outcomes. For example, how does a particular computer-mediated medium that uses audiographics contribute to student interaction? Michael G. Moore, in his editorial on the 1995 Distance Education Research Symposium, brings this issue to focus:

> We must begin to look at the distinguishing characteristics of these different settings. A further step is to ask how these contexts affect the learners, and their learning, the learning experience, process and outcomes *(Moore 1995).*

It would be a judicious for comparison studies to explore learner characteristics as well. As distance education moves from a marginal to integral role in higher education, learner characteristics and their role in the process of learning will become increasingly important

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(Powell, Conway, Ross, 1990). Traditionally, successful distance learning students have been identified as older, working students possessing time management skills, high self-motivation, a positive attitude, and risk taking personalities. Demographic changes, however, will eventually alter learner characteristics. Characteristics of success that have previously defined successful distance learning students may not be characteristic of a new distance education population.

Concern: Distance Education as Big Business

Several faculty members at Canton College expressed their concern that distance education has increasingly become a consumer commodity, rather than a vehicle of education. They believe profit is the primary motivating factor in the implementation of distance education in colleges and universities across the country. A recent editorial in *AFT ON CAMPUS*, November 2000 supports this conclusion: "Wall Street is waging huge sums on the convergence of education and the Internet. There's e-commerce, now there's e-learning" (Gladieux 2000,10). Wall Street's interest in online higher education has spurred college administers interest in online education. Green (2000) cites a recent article in *Forbes*: "[Business-to-consumers} is yesterday's story. Education-to-business and education-to-consumers is tomorrow's."

Traditionally private, for-profit companies occupied the technical training or blue-collar aspect of the distance education market.This is changing. For-profit education companies such as HungryMinds, SmartPlanet, eHigherEduation, SmartForce and eLearning are now competing with colleges and universities for the market share of distance education programs in continuing higher education. SmartForce reported sales worth of $189 million in 1999; eLearning generated revenues of nearly $100 billion (AFT ON CAMPUS 2000).

Increasingly, these same for-profit institutions are also competing with colleges that offer credit courses and degrees. The response of public institutions to the incursion of these companies has been twofold: colleges are now forming partnerships with such companies, or they entering the for-profit field themselves. (Moore 2000). The University of Colorado, for instance, has formed a partnership with eCollege, the large for-profit education industry (see Appendix C). New York University has created its own for-profit educational company, NYU Online. The University of Phoenix, with a student population of at least 56,000, is the largest for-profit university in the US. Other corporate alliances and educational institutions include California State University and the publishers Simon & Schuster likewise, the University of Washington has entered a partnership with Prentice Hall.

Consider the following Internet headings:

- **REPRESENTATIVES OF NEW YORK UNIVERSITY'S ONLINE DEGREE PROGRAM** are talking to agencies about NYU Online's estimated $10 million budget (*Brandweek Online 2000*).

- **COLUMBIA UNIVERSITY ESTABLISHES NEW COMMERCIAL VENTURE IN ONLINE EDUCATIONAL RESOURCES** Commercial business will be used to develop online courses and build strategic alliances with the most competitive Internet related businesses (*Chronicle of Higher Education* 2000).

- **'E-LEARNING EXPERIENCE'**
Universities 21, a network of 18 prominent universities in 10 countries, announced plans Monday to develop online-learning materials with Thomson Learning – a division of the Thomson Corporation, an international company focusing on electronic delivery of information (*Chronicle of Higher Education 2000).*

- **WHAT MAKES A 'DOT-EDU'?**
Community colleges have stepped up their fight for the right to use World Wide Web addresses ending in ".edu" – an increasingly coveted distinction as colleges and companies compete for distance-education students online. (*Chronicle of Higher Education 2000).*

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based forms of distance education, institutions no longer occupy certain geographic niches or maintain their existing

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spheres of influence (Moore1999). Consequently, external competition has forced many colleges and universities to enter the global educational market. Institutions are adopting strategies to ensure competitiveness; these strategies include distance education.

> Education on demand will dominate the marketplace and those institutions that can adapt to those changes will thrive. Those that do not may find themselves out of business (Olcott 1996).

Just what are the implications of merging distance education with big business?
Michael Moore, in his editorial on distance education and big business, expressed the following concerns:

1. Distance education will contribute to *widening the issue of inequity*. The traditional spirit of distance education was to provide access to those people denied opportunity to conventional education. Access today to the new distance education requires access to the new technology. "Americans living in rural areas are still behind those in urban areas in Internet access."(Moore 2000).
2. Distance education will *align itself to the principles of business*. Investments will be targeted in the rich markets of the health industry, business and information technology. Continuing education needs of the rest of society may not be addressed.
3. *Price wars*, common in the private sector and industry, will infiltrate education. Will institutions that undercut each other's price, undercut quality as well?

Some question whether school itself has been transformed into a lucrative market (Apple). In "Digital Diploma Mills" David Noble condemns distance learning as the "degradation of the quality of education in pursuit of the dollar" and maintains that dollars not pedagogical interest, are behind these partnerships (Scheurman 2000,11). Noble views distance education as "the biggest threat ever" to institutions and faculty.

Many schools are unaware of the risks of associated with moving online. Schools rush online to increase revenues and for fear of being left behind in the competitive market. Today, 75 percent of two-and four-year colleges offer some form of online, and the number is expected to increase to 90 percent by next year (Green 2000). This represents a dilemma for smaller colleges and universities. Smaller schools offering online courses and degrees will have to compete with the larger, more prestigious schools like Duke and Harvard University for students. Colleges and universities will need to hire sales and marketing teams just to attract students to programs. "Marketing will become more costly as the field grows and name recognition becomes ever-more difficult to establish " (Green 2000). Software development companies can spend up to $ 1 million developing a single course. As more schools adopt the gold-rush mentality, questions exist who will survive in a crowded market have fallen by the wayside."(Green 2000).

In Joshua Green's essay "The Online Education Bubble" Green cautions college administrators to be wary of rushing online in a capricious and fickle Internet market:

> Many schools seem blissfully unaware of the risk associated with moving online. Online education could be the latest in a string of over hyped Internet concepts in which an excess of giddy supply overestimates the demand (Green 2000).

College administrators, like businessmen, view technology a s a vehicle for cutting costs and generating revenues. Technology means productivity. David Noble, an outspoken critic of distance education, believes online courses serve as "a potential means of generating revenue for universities while cutting labor costs to the core (*ON CAMPUS* 2000). However the data suggests that many industries experience performance enhancement with technology rather than an increase in productivity or profitability with technology (Fahey 1998). Colleges and universities are not immune to this productivity paradox. According to William Scheuerman, president of UUP and American Federation of Teachers (AFT) vice president: "You can't use the technology as an end to save a buck. Once education is driven by savings, savings become the goal and education slips to a subordinate position (Scheuerman 2000, 11).

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Concern: Appropriate Pedagogy

Canton College faculty expressed considerable concern regarding to pedagogical issues and distance education. Many of the traditional faculty that were interviewed for this paper characterize their teacher role as one of "content provider" and "skilled facilitator" whose primary teaching methodology relies heavily upon personal interaction with students. Faculty members believe that distance education, in either its synchronous or asynchronous form, is impersonal, lacking the impact of direct contact with students. Many view distance learning as a poor substitute for "face-to-face" instruction.

At the heart of this pedagogical debate is the issue of student-to-student, student-to-content and student-to-instructor communication. Interaction is vital to the learning process (Bruffee 1982 & Flanders 1970). It provides a dialogue and a framework for confronting ideas and negotiating meaning. Pedagogy that enhances communication and social presence ultimately promotes effective instruction. Therefore, strategies that encourage student involvement, provide individual feedback, and promote interpersonal relationships do best to foster interaction. Qualities such as voice variation, self-confidence, stage presence and mastery of information are equally as important. While all of these are essential characteristics of an effective and engaging instructor, they become even more critical in a distance environment. Faculty question whether such qualities and methodology can effectively be transferred to an environment in which student and instructor are separated by distance.

It has been argued that it is the essential role of the teacher to guide and monitor students through the learning process. Garrison (1990) maintains that students need interaction with the teacher in order to "question and challenge pre-existing viewpoints and validate the knowledge gained." Streibel (1998) believes student require an instructor's help in formulating, understanding and solving problems. If interaction is so critical to the educational process, how is this achieved in distance learning settings?

Much of the educational research surrounding distance education has been devoted to documenting learning outcomes, and less effort applied to understanding the essential nature of an educational learning experience. According to Wong (1987,p.9), the "focus of much institutional effort in distance education has been directed toward the packaging and delivery of knowledge for the independent adult learner…[and] little attention has been paid to the nature of the human-to-human and human-to-machine interactions in the learning process. Institutions emphasize putting courses online rather than the choice of appropriate pedagogy (Winograd 2000). As Eastmond (cite) points out, "process fall short of theory."

Furthermore, educational research has not evaluated the effectiveness of interactive strategies that are currently being promoted and used by distance learning instructors. Chat rooms, discussion forums for students, are commonly employed as an interactive tool promoting communication among classmates. While chat rooms do provide students with the vehicle to discuss ideas among themselves, they may also lead to the reinforcement of mistakes and misunderstandings of course materials. Interactive strategies would do best if framed by educational research.

Other questions persist regarding appropriate and effective teaching strategies in a distance learning environment. How do instructors achieve elaborate encoding (i.e., the conscription of learning in a meaningful way in their distance courses)? Some educators recommended that frequent, short quizzes with scores and comments displayed assist in elaborate encoding and reinforcement (*Syllabus* 2000). Once again these may be worthwhile teaching strategies, but studies validating these findings are lacking.

Concern: Student dropout rate

Many Canton faculty associate distance education with high attrition and believed that student profiles are the most likely factors influencing course completion. Research, however, indicates multivariate reasons for student drop out. While descriptive analysis points to learner characteristics as a pivotal factor in student attrition (Rekkedal (1993, 19), learner characteristics are just one part of the puzzle. Kennedy and Powell (1976, 61) reported that students may drop out of distance education courses because of academic intimidation and the fear the lack of ability "to learn to debate and communicate in a manner which is acceptable to the academic community" (Cookson 24). Recent research using a micro-sociological approach to analysis suggests a combination of student characteristics and life circumstances preclude students from completing a course:

> The individual part-time student has a difficult time in maintaining an equilibrium of pressures within his life, pressures arising from his job, from his domestic situation, from his academic work and also from possible variations in his own personality (Kennedy and Powell 1976 ,61).

Ostman and Wagner (1987, 47) studied of the influences of demographic, social interaction, psychological, and institutional variables on course withdrawal and found that lack of time constituted the most influential single predictor of discontinuance."

Concerns: Workload, compensation

NEA (2000) findings support faculty concerns of increased workload and inadequate compensation:

- Over half (53%) of distance learning faculty spend more hours per week preparing and delivering their distance learning courses than they do for a comparable traditional course.
- In spite of spending more hours on their distance learning course most (84%) of faculty receive no course reduction. 63% are compensated for their course as if it were part of their normal course load.

Yet, such data does not address the role providing institutions play in the support and design of distance learning courses. Access to instructional designers and other support personnel could greatly reduce time spent delivering instruction. Likewise, time and effort is dependent on the degree of interaction between instructor and student. Courses that encourage interaction require more time investment. Workload can be reflective of institutional support as well as individual instructor strategies.

CONCLUSION

Faculty members at Canton College acknowledged the value of distance education in providing access and time flexibility to non-traditional working students. They were, however, doubtful about the quality of distance education and concerned about the impact distance education may have on their profession. Both academic areas at Canton College expressed similar viewpoints regarding distance education. While members of the science, medical and technology areas of the college were the ones most likely to utilize some form of technology in their instruction, they nonetheless expressed similar concerns regarding distance education as did the humanities and liberal arts curricula. Analysis of faculty concerns at the college did not portray any one faction as vehemently for or against distance education. This was quite the contrary to the dialogue expressed at faculty meetings. Perhaps the context of one-on-one interviews influenced the presentation of opinions.

Many of the concerns that Canton College faculty expressed during their interviews are shared by other institutions of higher education as well. A recent transcript in the

Chronicle of Higher Education (2000) detailed a discussion between regarding the impact of distance education (specifically online education) on community colleges. Much of the dialogue echoed the issues Canton College faculty raised during their interviews. Community college faculty expressed concerns over standards for distance education, attrition rates, competition choking or reducing offerings, quality of instruction, workload release time, support, faculty rights and compensation.

Faculty members at the college believed that little educational research has been applied to distance education. This is not true. Much inquiry has been dedicated to quantifying learning outcomes. Invariably, comparative studies of distance education and classroom instruction have proven time and again no significant difference between distance education learning outcomes and those of traditional instruction. However, such research fails to address the complexities of distance education, doing little to explore the theoretical foundations of the field. Recent studies, however, have begun to investigate the social experience of distance education, documenting learner perception, experience and attitude.

Faculty members question the pedagogical soundness of distance education. Many view distance education as an assembly-line approach to education, a medium for delivering more data and less knowledge. They argue that distance education hinders interaction, precluding the exchange of social and verbal cues between instructor and student. Pedagogical approaches that increase interaction and successfully engage students in the process of learning would most likely augment student scholarship. Yet such approaches have yet to be informed by educational research.

The evidence supports faculty concerns that distance education is a vehicle for big business. Partnerships between corporations and major universities are increasingly common. Institutions are forced to compete for students as never before. The effect of such competition will have on smaller schools that have limited resources and visibility remains unclear. Administrators view distance education as a cost-saving and revenue-generating measure. The following excerpt from Michael Moore (2000) is a sobering reflection on the relationship between distance education and the business model of productivity:

> Plans at the University of Georgia Board of Reagents call for the entire first two years of the university curriculum to be available over the Internet, and for complete degree programs in all traditional disciplines to be available by 2002. One curriculumwill be offered to every student in the state. The board will select faculty members (eight per course) from throughout the state university system to construct each core course. There will be a designated instructor/facilitator for evaluation. Facilitator faculty will have no academic freedom regarding the courses they teach (Moore 2000).

PERSONAL REFLECTIONS

As I listened to my colleagues discuss distance education I could not help but sense their apprehension over the rapid changes in education. They seemed, however, resigned to the fact that higher education, despite our best protests and ideological concerns, was on a path of change that none of us had expected or anticipated twenty years ago.

Distance education is a reflection of the changes occurring, not only in high education, but in society as well. Technological advancements such as the Internet have shaped businesses and influenced policies, both governmental and educational. While distance education has made it easier for people to access higher education, the technology that drives its delivery is unavailable to many. Ironically, the same technology that seeks to avoid inequity, may be the cause of it.

Distance education also forces us to re-evaluate our roles as faculty, students and institutional members. Many in the educational community are reluctant to embrace its concept. They cite issues such intellectual property, fair compensation, impact on quality of education, increased workloads, adequate compensation for development and implementation of courses and decreased student-learner interaction as mainstays of their resistance. These issues are real, and yet to be resolved.

The lack of sound pedagogy is perhaps the most critical issue for me. Suggestions from experienced distance learning instructors regarding effective methodology and teaching strategies do not bear the weight of sound educational research. I believe there is much to learn about the social learning experience of students in a distance learning environment.

I also believe that colleges and universities ignore the realities of market demand. Distance education is not a substitute for the budget woes or fiscal dilemmas that plague our colleges, nor is it a substitute for the day- to - day interactions that define the brick and mortar experience of traditional education.

General Studies

Interview #1
Profile: Sociology professor 12 years
Experience with distance education: little

Primary Concern	**Comments**
Loss of student/teacher relationship	Primary role as a teacher is "sage on stage". Teacher-centered pedagogy. Paid to interpret information and giving information is "contingent upon reading my cues from my audience."
Other concerns	**Comments**
Student characteristics	Traditional students seem to lack self-discipline. How would such a student fit into or succeed in a distance learning environment? A campus setting allows physical presence of the instructor at a set time, not possible in distance learning settings.

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Education as big business	See institutions as public service trying to emulate a business model and make faculty entrepreneurs (this affects teaching).
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary

Interview #2
Profile: Psychology professor 17 years
Experience with distance education: little; experienced with multimedia

Primary Concern	**Comments**
Impersonal process Little interaction outside the classroom Can not extract the social process	Allows image to be the role model Focus not on student-teacher interaction, rather, on "presentation material" Virtual skills –only apply in a virtual world
Other concerns	**Comments**
Quality of education	Distance education diminishes quality
Emergence of "two tiers of education"	Virtually educated vs. Traditionally
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary

Interview #3
Profile: English professor 20 years
Experience with distance education: none

Primary Concern	**Comments**
Lack of student interaction	Face-to-face a priority One-on-one interaction- office hours Lectures more effective in delivering instruction
Other concerns	**Comments**
Lack of training	Would need a lot
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

Science, medical and technology

Interview #4
Profile: Wireless Communication 12 years
Experience with distance education: none, extensive multimedia

Primary Concern	**Comments**
Student motivation (learner characteristics)	Students are not motivated in class, less so in an online environment
Other concerns	**Comments**
Lack of interaction	"Interface tends to alienate" People go to college for interaction- the college experience (You can't have bear blast over the Internet!)

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Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

Interview #5
Profile: Chemistry Professor 28 years
Experience with distance education: none, extensive multimedia

Primary Concern	**Comments**
Student achievement	Would be poor for traditional 18-20 year olds.
Other concerns	**Comments**
Lack of personal interaction, although this is course dependent	Face-to-face interaction provides motivation. Acknowledges that discussion can occur in distance education environment
Support issues	Need adequate communication between instructor and (infrastructure)computing center
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

Interview #6
Profile: Biology Professor 4 years
Experience with distance education: none, extensive multimedia

Primary Concern	**Comments**
Lack of student interaction	Role of the professor is to provide motivation, create interest, explain concepts, provide direction. Would be difficult to transfer this approach to a distance education format
Other concerns	**Comments**
Student achievement	Believe significantly lowered
Student motivation	"Traditional students can't pay attention"
Distance education is "edu-tainment"	Traditional education emphasizes content; distance education emphasizes delivery
Marketing	"Who wants 100 Introduction to Biology courses?"
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

Additional comments:

- Lack of educational research frames distance education
- Pedagogical approach would be difficult to transfer to a distance learning environment
- Administration encourages faculty to produce online courses. Appropriate pedagogy not addressed.
- Validity of distance education noted: expanded opportunities for commuters and working non-traditional students

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Implementing a Laptop Program at a Small, Liberal Arts University

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Abstract:

In the fall of 2000, the University of the Incarnate Word, a small, Catholic, liberal arts university located in San Antonio, Texas became the largest IBM ThinkPad University in the South. At present, 2000 laptops have been distributed to students and faculty. This paper will explain the implementation process and the components that made this a successful program. Commitment from the University leadership, involved corporate partners, a broad-based planning team, effective communication, faculty training and a supportive infrastructure lead to a positive first year experience for students. The paper discusses problems that were encountered and makes recommendations to institutions that might be considering such an initiative.

Introduction:

In the fall of 2000, the University of the Incarnate Word became the largest IBM ThinkPad University in the South. At present, 2000 laptops have been distributed to students and faculty. This paper will explain the implementation process and the components that made this a successful program. Commitment from the University leadership, involved corporate partners, a broad-based planning team, effective communication, faculty training and a supportive infrastructure lead to a positive first year experience for students.

The University of the Incarnate Word (UIW) is a small, Catholic, liberal arts university located in San Antonio, Texas. The University enrolls 4,283 students, of which 3,519 are undergraduates. Seventy-one percent of UIW's student population can be designated as minority. The student population reflects that of the city, with the majority coming from Hispanic (54%) households. Most of the students are first-generation college attendees who use financial aid to pay for their education (77%). The University qualifies as a Hispanic Serving Institution.

Based on our student demographics, the UIW leadership has had a great concern about the increasing "digital divide" between the Anglo and the minority populations. In August 2000, the U.S. Commerce Department reported in *Falling Through the Net: Toward Digital Inclusion*, that the national average for computer ownership was 51%, but the penetration rate was only 33.7% for Hispanics households. The report indicated that the most Hispanics access Internet services from schools, libraries and work rather than from home. (Only 16.1 % of Hispanics access the Internet from home.) With technology use patterns such as this, if UIW did not provide the students it serves with access to technology, who would?

At the University of the Incarnate Word, technology literacy is seen an important part of the liberal arts core curriculum. Students are required to take a course in computer literacy and the integration of technology into courses in the major is standard instructional practice. For many years, there has been budgetary support for infrastructure improvements, the creation of computer labs and for technology skill development among faculty. Still, it had been difficult to keep up with the increasing demand for access to technology. The student to computer ratio was high, there were not enough staff to keep labs open 24/7 and there was the expense of refreshing the technology every 3 years. Requiring students to have laptops seemed like a good solution to these problems. The question raised, however, was how could the program be affordable for our students who already have trouble paying tuition?

Initial Planning

In the fall of 1999, a Laptop Planning Team made up of faculty, administrators, staff and students was charged with investigating the potential of a pilot program that mandated laptop purchases for all junior and senior business majors (500 students). The Dean of the Business School was trying to respond to a recent employer survey, which indicated that employers considered technology skills a major factor when hiring business school graduates. The Laptop Planning Team identified three goals for the program: (1) put standardized technology into the hands of the students; (2) embed technology into the learning experience; and (3) give students the required technological skills to make them successful after graduation.

Initially, the team used the Internet and telephone interviews to survey other universities that had laptop programs. The Dean and the Chief Information Officer visited the small, Catholic St. Gregory's University in Shawnee, Oklahoma, which has had laptop program since 1997. Major laptop vendors (IBM, Toshiba, Dell, Gateway, Compaq) were asked to do presentations. The Laptop Planning Team prepared a report for UIW's President. After reviewing the recommendations, he decided to expand the pilot beyond the business students to ALL fulltime sophomores and juniors, an estimated 800 students in the Fall 2000.

Through a competitive procurement process, in which a formal request for proposal was prepared and sent to each of the five major vendors, IBM was selected as UIW's corporate partner. IBM's proposal included leasing the laptop computers over a 3-year period, technical support for broken computers, and insurance in case of theft. The laptop chosen was sufficiently robust to connect to the campus network and to run standardized productivity software. IBM offered additional support in sharing their experience with other ThinkPad universities. They provided such assistance as sample letters to students and parents, examples of laptop orientation materials and information on policies and strategies used by other schools. In addition, IBM representatives became a part of our Laptop Planning Team. Our IBM representative drove down from Austin every two weeks to attend the team meetings.

The team determined that each student would receive a laptop, a printer and a backpack. This would eliminate the need to install networked printing stations around campus. In addition, each laptop would have a standard software installation. A Microsoft Campus site license was purchased so that faculty could expect all students to have the basic productivity tools. Standardizing hardware and software would allow the technical support staff to limit the problems that typically occur when dealing with differing configurations. The need for more technical staff was factored into the plan. The team estimated the cost of the lease and the necessary support to be about $1,100 per year. The University leadership made a major commitment to finance the program by providing a $300 technology grant each semester so that students had to only pay $500 per year for their laptop. At the end of 3 years, students would be able to purchase the laptop for $1. IBM has reported that UIW has the lowest priced ThinkPad University program in the United States.

The University Board of Trustees approved the plan in the spring of 2000 for implementation that fall. Getting the word out to the students about the program was a challenge. Students were informed through various means, including direct mail, student forums and via a web site (http://www.uiwtx.edu/~Laptop). A Laptop Appeals committee was established to deal with students who felt that they should be exempt from the program. Currently, all recruitment literature has been revised to include the laptop program and the University extensively advertises itself as an IBM ThinkPad University.

Laptop Deployment

During the summer months of the first year, the laptop orientation session was planned. It was planned as a 2-hour session where students would be given their laptops, check inventory, sign the leasing agreement, plug in and connect to the network, set up their machine for networking and e-mail and informed of computer policies and services. The sessions would be held in a wired lecture hall that held 65 students. Our intent was to keep the distribution session small so that there would be enough technical support. Students had to register for the sessions at the laptop web site. The orientations were scheduled for the week before school started. Unfortunately, due to a delay in manufacturing the new ThinkPad model, these sessions had to be delayed until mid-September. Students were contacted by mail and by phone concerning the delay. To make up for the situation, IBM agreed to provide a wireless card for free with each of the laptops.

The laptops were distributed in 18 orientation sessions, which spread over a 4-week period. Representatives from the technology services, financial aid, business office, student body and IBM manned the distribution stations and served as technical support. One lessoned the team learned was that not all students are willing to pick up their laptops, even though they are being charged for them. Many missed the sessions for which they had registered. Therefore, additional small orientations had to be scheduled. There were also those who delayed until their appeal to the Laptop Appeals Committee was heard.

Preparing the Faculty

The student laptop distribution was only part of the University plan. During the first year of the program, all 138-fulltime faculty received laptops. A Hispanic Serving Institution Title V grant allowed UIW to offer extensive technology training to faculty during the summers of 2000 and 2001. More than 50% of the faculty have participated in the Title V training. On-going training during the regular school year, a technology fellowship program and instructional technology support staff have helped faculty to integrate the laptops into their teaching.

Another means of pushing integration has been the implementation of Blackboard 5 (Level One), a course management software package. The product has proven to be easy to learn; and has been adopted by an overwhelming number of faculty (62%). Three 2-hour workshops introduced 60 faculty to Blackboard before the Spring 2001semester. Last summer 40 faculty participated in a weeklong seminar, which focused on online pedagogy as well as provided hands-on experience with Blackboard. At present, there are 2,000 students taking 120 Blackboard enhanced courses (an 82% increase from the spring semester). The University intends to migrate to the portal solution, Blackboard 5.5 (Level 2), during the Spring 2002 semester. Blackboard is changing the instructional environment, and the way in which instructors and students communicate. With the portal product, the University expects to draw the entire community to one place where students, faculty and staff go to find information, to communicate and to get support.

Infrastructure & Support

Having 2000 additional computers on campus has forced UIW to enhance the infrastructure - not only in terms of the network, but also in terms of software and technical personnel. In the summer of 2000, the campus was 48% wired; now it is 100% wired. A decision was also made to implement wireless networking in the library, in classroom buildings, and in student gathering areas. The University expects to spend $350,000 over a two-year period to make the entire campus wireless. Recently, the University was awarded a Texas Infrastructure Fund grant of $100,000 to offset some of the cost. Shortly after the laptops were distributed, the network was working at 100% capacity. Students were taking up all the bandwidth by downloading music, videos and making international phone calls over the Internet. The University has since had to add a packet shaper to prioritize the amount of bandwidth various applications use on the network. A virtual private network has been installed to increase security. The additional strain on the network has caused the University to increase the number of T-1 lines from 1 to 3. Finally, plans are being made to purchase a network sniffer to help the infrastructure staff keep track of how the network is being used

A newly established Technical Support Services now employs 3 fulltime staff and 10 student workers to support the laptops. Clearly the number of staff pales in comparison with other institutions, but at this point, the workload is manageable. When the staff cannot fix the equipment, it is sent to IBM for repair. However, help desk hours are limited to daytime hours during the standard workweek. To augment support, Technology Services is developing online resources and tutorials so that laptop users can get help 24/7 via the Internet. Building renovations were completed to create a space for the technicians and for storage of laptops. A walk up help desk area was created and a gated room was outfitted with wire mesh on the walls and ceiling so that large quantities of laptops could be securely stored.

In addition to office renovations, changes are planned for the classrooms. A laptop classroom is being created with a counter that surrounds the perimeter of the room with data jacks and plugs for 25 laptops. With laptops in the hands of students and faculty, the requests for data projectors in the classrooms have increased. This year $50,000 from the Title V grant will provide the University with projectors for our main classroom building. As new facilities are planned, projectors and wiring are included in the construction budget. Although the laptops have batteries, providing electricity to old classrooms has become a major concern from faculty who want students to bring their laptops to class.

Problems

Of course, there have been problems with the implementation that were not anticipated. During the first year, student attitudes toward the program were not as positive as expected. Some students refused to pick up their laptops. Many complained openly in student forums and in the school newspaper. However, there has been a change in attitude during the second year. Students were much more excited when receiving their laptops. As an indication, this year 71% of the freshmen opted to get a laptop rather than wait until they are sophomores. Other complaints have come from graduate students and adult degree completion program students who were not eligible for the program but who wanted laptops. IBM has now established a direct purchase program for these students as well as for faculty, staff and alumni. Students who received laptops last year have complained because this year's model is faster and has more capacity. They want a way to return their model and get the newest one. A two-year refresh program would help with this problem, but the University is not prepared to commit to this change at this time.

Students, who graduate or withdraw from UIW, can purchase their laptop. Unfortunately, some students drop out without notification and without returning the laptop. In the orientation, students are warned that felony charges will be filed against them if they fail to return their laptops upon leaving school. The practice is to send these students two letters requesting the return of the laptop and a final certified letter demanding the laptop back. The first year there were 12 such incidents. Our response was to file charges with the police department and the district attorney's office. Regrettably, the local district attorney has decided that criminal intent was not evident in these cases and that the matter should be handled in civil court. Complicating matters further, is the fact that laptops are being leased from IBM, who actually owns the laptops. Admittedly, the University does not yet have a successful and easy solution to this problem.

The University has found a solution for what to do with the returned laptops. The University has offered the leasing option for the "used" laptops to departments within the institution. This allows them to spread the cost of the laptops over two budgetary years, making it more affordable. The laptops are insured for theft and have the IBM asset protection plan, which makes the offer more attractive. The adult degree completion program and the high schools that are associated with UIW are planning to outfit several laptop labs using these machines.

Lessons Learned

The UIW experience has much to offer any institution that is interested in implementing a laptop program. The UIW Laptop Planning Team could offer this advice.

1. Form a planning team made up of representatives from all of the university constituencies who are impacted by the program. Expect to meet regularly through out the year.
2. Research what other schools have done and do site visits to schools that are similar in size and budget.
3. Carefully prepare a request for proposals for laptop vendors that allow the team to make comparisons. Look for vendors that are willing to do more than just sell laptops at a good price. Consider experience, support and commitment. Look for a service plan and a way to insure the equipment.
4. Standardize the hardware and software selection so that it is easier to integrate into the classroom experience and so that it easier to service.
5. Use a variety of methods to inform students and parents about the project. Expect complaints about the program and develop mechanisms for appeals.
6. Prepare the faculty by giving them the laptops first and by providing training to support the integration.
7. Expect to upgrade the infrastructure. The students will be using the network in ways that will eat up bandwidth.
8. Expand the technical support services on campus. Do not put together a plan without making this a part of the budget.
9. Spend time on the orientation plans. More time spent with the student during orientation means less time spent on service problems later.
10. Develop accessible instructional materials to help students use the technology. Do not expect them to pick it up on their own or to get it in class.
11. Find a killer application such as Blackboard to push the use of technology into the classroom and into the lives of the university community.
12. Plan for classroom arrangements and technology to support students and faculty taking laptops into the classrooms.
13. Develop policies to handle the problems such as non-returned laptops and acceptable computer use.
14. Be patient and flexible. Changes do not occur overnight and some unanticipated problem will always come up.

The University is now in its second year of the laptop program. Despite the problems that have occurred, the University leadership is committed to keeping the program. The mission of the institution states that "The University is committed to educational excellence..." and is "open to thoughtful innovation that serves ever more effectively the spiritual and material needs of people." The laptop program is supportive of this mission. It puts technology in the hands of students, who otherwise would not have access. Laptop ownership gives students the tools they need to complete their academic programs and allows them to develop the skills needed to compete when they leave the institution.

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Community of Practice: What is it, and how can we use this metaphor for teacher professional development?

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Abstract

In this paper I provide the reader with the definitions and characteristics that are often associated with the community of practice metaphor. Then I propose that community of practice is an appropriate tool for descriptive research or improving the interactions that take place in a community, but not necessarily an appropriate instructional tool for designing and developing learning communities in schools. I demonstrate this by reporting on findings from a case study of a teacher professional development program for technology curriculum integration

Introduction

In the past decade community of practice has become a popular term in both educational and business settings. Many of its implications are in alignment with situated learning theories, sociocultural learning theories, and organizational learning theories. Community of practice as a metaphor provides researchers with a theoretical lens for explaining why members of a community do what they do in everyday settings, and how community members define practices and engage in identity formation. The notion of community of practice provided the educational research community a method for explicating cultural knowledge that is often times a tacit set of rules and rituals that function as a lens through which members of a community view and interpret the world and give order, significance and meaning to their experiences (Maynard, 2001). The endorsement that community of practice has won in the field of educational research represents the ideological shift that occurred during the late 1980s where researchers began to express their interest in examining learning in everyday settings rather than school settings (see Brown, Collins, & Duguid, 1989; Lave, 1988; Resnick, 1987; Rogoff, 1990).

Consequently, there has been a plethora of research surrounding community of practice in both educational and business settings. Many of these efforts have been based on research using ethnographic methods. The outcomes of these ethnographic studies have helped identify the characteristics and mechanisms of community of practice especially how it influences organizational learning and individual learning. Thus within educational research community of practice has become an interesting and useful metaphor for describing and understanding organizational learning. However, for the community of practice metaphor to mature as a research and development framework in educational settings, we need more discussions surrounding how it can be used as a metaphor for improving preservice and inservice teacher education. This manuscript will specifically focus on inservice teacher professional development.

The charge of this manuscript is to: (a) reexamine the definitions and characteristics that are often associated with the community of practice metaphor; (b) clarify that this metaphor is a theoretical tool for educational researchers make sense of interactions that take place in educational settings; and (c) use the community of practice metaphor as a theoretical lens to reflect on interactions that took place at a rural Midwestern school district that was involved in a teacher professional development program. I will conclude with suggestions on how to use community of practice as an instructional deign tool for supporting and enhancing organizational learning. The data presented here has been extracted as a portion of a larger multiple case study that took place in two rural Midwestern school districts during August 1998 to May 2000.

Literature Review

Community of practice is a term popularized by Lave and Wenger (1991) when they examined the legitimate peripheral participation of apprentices in professional communities. They claimed that apprentices of a community of practice are given legitimate roles within the community, and their actions have a direct consequence for the entire community. As an apprentice gradually appropriates the skills that are necessary for her to become a more skillful member of the community, she is assigned legitimate tasks that have greater consequences. Within this theoretical framework, communities of practice consist of groups of individuals with common goals who are engaged in joint activities in a common setting. The way that work related activities are exercised in a community of practice affects the way that its members view the world, and it also defines the legitimacy of a task practiced in the community. Lave and Wenger (1991) define the term as follows:

> A community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage. Thus, participation in the cultural practice in which any knowledge exits is an epistemological principle of learning. (p. 98)

Additionally, the history and experiences shared in a community of practice defines what constitutes competence within that community (Wenger, 2000). In other words, the shared experiences within a community define the legitimacy of practices that are carried out on an everyday basis.

Interestingly, the focus of Lave and Wenger's work was not to identify and define the notion of a community of practice. They focused their work on illuminating the setting, processes, and individuals involved in professional communities, such as the Yucatec midwives and naval quartermasters. Lave and Wenger introduced the notion that community members consist of newcomers and old-timers, and the learning activities involved for a newcomer to transition to an old-timer is extraordinarily situated in the everyday practices of the community contrary to learning experiences that K-16 learners face in schools. Lave and Wenger used community of practice as a descriptive metaphor in their anthropological studies involving legitimate peripheral participation to portray how a community makes meaning of the world and how the world and individuals' identities are defined by the history and practices shared by the community members. Lave and Wenger never made any claims from the implications of their study about how to constitute community of practices in educational settings (Palincsar, Magnusson, Marano, Ford, & Brown, 1998).

Wenger (1998) further examined the concept of community of practice. In his 1998 work he provided definitions of community, practice, and identity formation within a community. He reported that community practice is an integral part of our daily lives, and it is everywhere. Communities of practice do not have a name or a membership card, but members of a community of practice identify themselves as a "we" defined by the joint participation for attaining a common goal. This notion of "we" draws boundaries between multiple communities of practices, and these boundaries can act as an important agent for learning systems because they connect communities and offer opportunities for learning (Wenger, 2000). Community members that cross over to another community of practice are exposed to practices and artifacts that are new to them. These new experiences can allow individuals to engage in activities that they never did prior to the boundary crossing. Then these individuals can bring back their newly negotiated understandings to their original community by becoming the brokers of the new practices (Wenger, 1998).

Wenger (1998) cautions that community of practice is not a new solution to existing organizational problem, and "they are not a design fad, a new kind of organizational unit or pedagogical device to be implemented" (p. 228). Wenger further explains that:

Communities of practice are about content—about learning as a living experience of negotiating meaning—not about form. In this sense, they cannot be legislated into existence or defined by decree. They can be recognized, supported, encouraged, and nurtured, but they are not reified, designable units. (p.229)

Finally, Wenger (2000) cautions researchers not to romanticize the notion of community of practice. At the same time that a community of practice supports learning, it can also be the mechanism that enables individuals to learn the practice of not learning. Therefore, a community of practice is not necessarily always advantageous for human everyday practices.

The field of educational research quickly adopted community of practice as a conceptual tool for both research and instructional design. As a research tool community of practice has been used to identify individual identity formations and interindividual interactions that take place within a classroom setting or a broader educational setting (see Matusov, 1999, 2001; Maynard, 2001). As an instructional design tool community of practice has been introduced as an architectural guideline of instructional environments as used in Barab and Duffy (2000) and in Palincsar et al. (1998). However, in these instances the authors stumbled into situations where they realized that community of practice could not be used as a pedagogical device for designing communities in K-16 education or in teacher professional development. For example, Barab and Duffy used community of practice as the overarching metaphorical notion for providing K-16 students a highly situated and authentic learning environment. Thus, they point out the shortcomings of using community of practice as an architectural tool of learning environments because the experiences learners encounter in school settings are alienated from the real problems that community of practices encounter. To alleviate this shortcoming Barab and Duffy suggest instructional designers to use the notion of practice fields (Senge, 1994) in K-16 educational settings.

Palincsar et al. (1998) used community of practice as a design tool for tracking the birth and growth of a community within a teacher professional development program that focused on improving classroom practices of K-5 teachers specifically in the area of science education. However, the above authors point out themselves that it is difficult to use community of practice as an instructional design tool for professional development because within the everyday work life of teachers there is a lack of a commonly shared mission or a joint enterprise (Hargreaves, 1993), and teachers lead individualistic and isolated work lives (Little, 1990), where they do not necessarily feel as they are a member of a community of practice. Ironically the attempts for using community of practice as an instructional design tool for architecting educational environments have reinforced Wenger's (1998) position that community of practice is not a designable unit. Instead, community of practice is a useful tool for identifying and supporting community efforts in order to improve and assist the educational efforts of a group of individuals.

This Study

TICKIT

This study took place in the context of a teacher professional development program about technology curriculum integration. The program that the study participants were involved in was the Teacher Institute for Curriculum Knowledge about Integration of Technology (TICKIT). TICKIT is a university school partnership between five rural Indiana schools and Indiana University. Each year, in this program there are at least 25 teachers enrolled, and they are responsible of developing, implementing, and evaluating at least two lessons that integrate technology in their subject area. During their participation, TICKIT participants are provided support from Indiana University staff and their local schools for integrating technology into their everyday teaching activities and for becoming technology leaders in their schools. In exchange, upon completion of all projects required in TICKIT, teachers receive six graduate credit hours that can be used toward either a master's degree or for revalidating their Indiana teaching license.

Methods

Participants

The initial participants of this study were selected from (a) school districts that enrolled in TICKIT for two consecutive years during the 1998-1999 and 1999-2000 school year, and (b) school districts that provided support for participant teachers. The primary participants were individuals who were: (a) TICKIT 1998-1999 participants who were classroom teachers, and (b) TICKIT 1998-1999 participants who participated in the entire yearlong program. The secondary participants were non-TICKIT teachers, administrators, technology coordinators, or technology support staff. Anonymity of the study participants was maintained by the use of pseudonyms for individuals and school district names. For the purpose of this manuscript, I will present a portion of the entire data from the Hillsdale-Berkley School District. At the Hillsdale-Berkley School District there were four primary participants, including two eighth grade teachers , one sixth grade teacher, and one third grade teacher, and five secondary participants, including two teachers, one media specialist, one technology coordinator, and one technology support person.

Researcher Role

The above participants and I were well acquainted with each other during this study because I was the TICKIT graduate assistant that maintained the website, conducted technology related workshops for participants, and provided any other assistance requested by the program coordinators or TICKIT participants. Therefore, there were moments during this study when I took the role of more than an outside observer. For example, when there were inservice technology sessions at the Hillsdale-Berkley school district, the teachers were very eager for me to participate, partly for my data collection purposes and partly so that I could help them with teacher training.

Data Collection Methodology

In this research, naturalistic inquiry methodology (Lincoln & Guba, 1985) was used, where the data collection took place in a natural setting and there were no variables manipulated in anticipation of confirming a hypothesis. More specifically, I conducted a case study (Merriam, 1998; Stake, 1995). The data collection methods included document analysis, interviews, and classroom observations with 1998-1999 TICKIT participants, non-participating teachers, and school technology support staff.

Trustworthiness

I attempted to maintain the trustworthiness of this qualitative study by: (a) prolonged engagement with the research site, (b) persistent observation, (c) triangulation, and (d) member checking. Although this research began after the TICKIT 1998-1999 program, I had close ties with the participants during TICKIT 1999-2000. Therefore, I had a total of two years of engagement with the research site.

Data Presentation

School District Background

Hillsdale-Berkley School District is a rural Midwestern school system with minimal industry in the community. The district serves six schools (four elementary schools, one middle school, and one high school). Due to the rural environment in which the school is situated, it is isolated from many educational resources, such as public libraries and museums that could be available in more urban settings. The district's mission is to "encourage and direct the physical, mental and social growth of each student… so he can, to the best of his abilities, become a well adjusted, contributing member of our society" (Hillsdale-Berkley School District Technology Implementation Plan 1997-2001).

For the past five years the Technology Planning Committee, which is a district-wide committee, has been planning for the technology implementation plan. The mission of this committee is to "create, implement, evaluate and revise a long-range technology plan for learning that will move the students of the schools well into the 21st century" (Hillsdale-Berkley School District Technology Implementation Plan 1997-2001). The district acknowledges that electronic technology has become an integral part of the function of the community. Therefore, their goals state "learners and teachers will develop the skills necessary to effectively utilize technology ethically and creatively in serving both the individual and society" (Hills dale-Berkley School District Technology Implementation Plan 1997-2001).

However, many of the technology related initiatives, such as applying to various state grants and implementing technology in the curriculum, have been efforts pursued by pockets of enthusiastic teachers rather than a movement led by district administrators and staff. The common practice for gaining grant money, at the Hillsdale-Berkley School District, works such that the school library media specialist finds grant applications that fit a single or several teachers' needs; then the teacher will apply for the grant individually or with the media specialist's help. Therefore, grant application preparations are considered as extra workload for teachers, and they usually spend time after school hours to write grants. When the teacher or groups of teachers gain the grant money, it is distributed for their classroom use and not necessarily for school-wide initiatives

Hillsdale-Berkley School District and TICKIT

At the Hillsdale-Berkley School District, prior to enrolling in TICKIT, there were several self-motivated teachers experimenting with the use of technology in their classrooms. These teachers were interested in using technology, because when the integration was successful, it oftentimes provided a rich learning environment for students, and students were motivated to learn in this technology rich environment. The school district did not have funds for providing teachers with technology in their classrooms; therefore, the technology enthusiastic teachers applied for small grants that allowed them to provide the hardware and software in their classrooms.

Hillsdale-Berkley teachers worked in interdisciplinary teams, but technology related activities were contained within the boundaries of the classroom. Consequently, teachers did not develop the practice of sharing physical resources such as equipment and software or sharing teaching related ideas and stories. Furthermore, teachers that were not comfortable in using technology in their classroom did not consider the enthusiastic teachers' efforts as curriculum development. They perceived activities related to technology curriculum integration to be a hobby-like activity.

For some teachers at the Hillsdale-Berkley School District, participating in TICKIT gave justifications for non-TICKIT participating teachers to acknowledge the TICKIT participants' efforts. By participating in TICKIT, the teachers' efforts in integrating technology into the curriculum and prioritizing them over other teaching responsibilities were well accepted by non-TICKIT teachers. Becoming participants of a university school partnership program gave renewed sense of credibility to the activities surrounding technology that the Hillsdale-Berkley TICKIT participants were engaging in. For example, during her interview Naomi, an eighth grade Language Arts teacher, commented that when she shared the projects she completed in TICKIT with her non-TICKIT participating colleagues on her team, the project was acknowledged as an important curriculum unit and not "Naomi's computer project:"

> it's accepted better. It's not "oh...it's Naomi's computer project" now it's like "oh, their doing the WebQuest project." Which is a big difference...if it's my little project on the computer it's not valid. It's just that thing she does, but if it's a WebQuest, suddenly it's like part of the curriculum and they see educational value that they did not before. I think that changed the attitude a little bit. (Naomi, Primary Participant Interview, February 29, 2000)

This acknowledgement by non-TICKIT teachers, that the TICKIT participating teacher projects were part of the curriculum and not just a computer project, encouraged a change in attitude of the non-TICKIT teachers, and some became excited to participate in their schools' curriculum technology integration efforts.

At the end of the program, the Hillsdale-Berkley teachers felt that they gained new technology skills that made them feel more comfortable and confident in using various technologies in their classroom. With their newly gained confidence and technological skills, teachers at the Hillsdale-Berkley School District became eager to incorporate technology into their classroom. Deborah, an eighth grad Math teacher, commented on this in the following excerpt: "being comfortable of using the Internet ... being able to create Web pages...did a lot to me in making me feel comfortable...and try to do things for my students..." (Deborah, Primary Participant Interview, March 8, 2000). Furthermore, Alice, a sixth grade Language Arts and Social Studies teacher, felt that her newly gained confidence energized her and made her eager to continue to work on integrating technology in her classrooms. She mentioned during her interview that: "I am always thinking about ways [to integrate technology in the curriculum], what can I do, what can I do" (Alice, Primary Participant Interview February 2000). However, Hillsdale-Berkley teachers realized that there was not enough equipment for them to use in their day-to-day teaching, especially in the Middle School.

With the new sense of confidence, new university connections, and camaraderie shared among TICKIT teachers at Hillsdale-Berkley, teachers became eager and excited to apply for new technology-related grants. As the non-TICKIT teachers at the district witnessed several of the TICKIT projects and found that the school was purchasing more equipment they became interested in using technology in their own classrooms. Some non-TICKIT teachers even chose to enlist themselves in TICKIT for the 1999-2000 year.

The TICKIT 1998-1999 teachers continued to influence their non-TICKIT participating colleagues by taking a leadership role during inservice teacher training sessions and by making themselves available for helping other teachers. Emma, the media specialist, commented how the five TICKIT participants from her school have been helpful to other teachers.

> They've been helpful in helping people design other things too, and getting their Web page going or you know, designing a WebQuest too, so they've been good resources people. (Emma, Secondary Participant Interview, April 16, 2000)

For example, during February 2000, Emma coordinated a two session series of after-school inservice programs for teachers at Hillsdale-Berkley Middle School on Web publishing. Henry, a third grade teacher who participated in TICKIT, was the instructor for the inservice session, and many of the participants of the session were TICKIT 1998-1999 teachers. I observed the second day of one of these sessions, where teachers brought in the curriculum they wanted to publish on the Web and worked on it while Henry and Emma assisted in answering questions.

The first day of the in-service, according to Emma, was a typical training session where Henry demonstrated how to use Netscape Communicator. The second session was designed for teachers to bring their recent Web publishing projects and use the inservice time as work time. The TICKIT participants other than Henry who were present at the inservice were helpful in answering other teachers' questions while they were working on their own projects as well.

Discussion

When examining the historical development at the Hillsdale-Berkley School District prior to TICKIT, teachers enthusiastic about using technology in the classroom had to isolate themselves from their day-to-day teaching colleagues if they wanted to develop and implement technology infused curriculum. Within the everyday practice of teaching at Hillsdale-Berkeley, curriculum technology integration was not acknowledged as a legitimate teaching related practice.

Teaching efforts surrounding technology use in the classrooms were perceived by other teachers as indulging in hobby-like activities that satisfied individual interests rather than meeting curriculum needs with pedagogical values. Additionally, indulging in such "illegitimate" practices were potentially threatening to a teacher's career because it could have discredited their teaching as a whole by other local teachers. Inevitably, the self-motivated teachers that were enthusiastic about integrating curriculum and technology had to isolate themselves from the local boundaries of their teaching colleagues and choose not to share their ideas and stories regarding technology implementation with local colleagues.

While participating in TICKIT Hillsdale-Berkley teachers found other teachers interested in sharing and legitimizing the common goal of designing, developing, implementing, and evaluating new methods for using technology in the classroom that addressed curriculum and student needs. Based on the partnership build by becoming a TICKIT participant, these colleagues included teachers from their school district and outside of their school district, and university faculty. Here, the teachers from Hillsdale-Berkley found a new group of individuals to associate with while they excused themselves from their local colleagues. In this way, TICKIT introduced to them new peers for Hillsdale-Berkley TICKIT teachers to work together to develop technology-integrated lessons.

After TICKIT, once the Hillsdale-Berkley teachers attained their goal of a successful curriculum technology integration project, they became boundary brokers (Wenger, 1998) between the TICKIT community and their local community of teachers. After completing the program, TICKIT teachers from Hillsdale-Berkley brought to their local community new artifacts (i.e. successful curriculum technology projects) and stories surrounding those artifacts. These new artifacts and stories of TICKIT teachers acted as catalysts that encouraged other teachers to become involved in TICKIT for the following two school years.

Additionally after TICKIT, Hillsdale-Berkley teachers found a group of local teachers and technology staff who shared their vision for school-wide curriculum technology integration. These teachers wrote grants together to acquire funding that would support purchasing technology equipment and professional development activities for local teachers. Ordinarily, the community has great influence over shaping the everyday practices that teachers choose to engage in because the community defines the rules and division of labor associated with practices. However, as seen in the above example, community endorsement is not the sole predictor of success.

Innovations that are introduced to everyday practices of teachers, such as a professional development program, can change the perception of local practices, and legitimatize new teaching related practices that were formally illegitimate. For example, after TICKIT technology enthusiastic teachers in Hillsdale-Berkley no longer needed to isolate themselves from their local colleagues because the activities surrounding the use of technology in classrooms became legitimate. Therefore, TICKIT teachers did not need to belong to an outside group to attain their technology curriculum integration goals. They became a self-sustained group of teachers that shared a common goal and were acknowledged by many of their local colleagues as technology leaders in the district.

Through the above examination there are several transitions that can be identified. These transitions include the following: (a) the non-TICKIT teachers perception of TICKIT teachers' everyday efforts for integrating technology into the curriculum changed from a hobby-like illegitimate teaching practice to a legitimate curriculum development; (b) TICKIT teachers' perception of their own skills and confidence regarding technology use in the classroom changed from being mediocre and timid users of technology to skillful and bold users, and (c) the TICKIT teachers' identity changed from a closet technology user in the classroom to a technology leader in the district. The key artifact that became the catalyst for the above transitions was the TICKIT participating teachers' curriculum technology integration projects. These projects served the purpose of reified objects that helped institutionalizing and legitimizing new practices at the Hillsdale-Berkley school district.

Conclusion

In this manuscript I presented community of practice as a useful tool for examining interactions that take place in professional development settings in order to understand everyday practices within a teacher community and to identify what practices are perceived to be legitimate and what practices are not. Teacher professional development involves introducing and legitimizing new practices within the teaching community. In some cases, such as in this study, professional development programs can assist in nurturing and enhancing practices that are already practiced within a small group of teachers in a school district by introducing the non-practicing teachers to new artifacts that are reifications of legitimate pedagogical practices.

Using community of practice as a tool for examining local teaching practices within a school district can help universities, school districts, and teachers involved in a professional development program identify what are the accelerators and barriers of success for introducing new pedagogical practices. Once this is identified it is the task of the professional development program and its participants to leverage the local practices to identify methods for legitimizing new teaching related activities. Therefore, community of practice can be used as a theoretical lens for identifying, supporting, and strengthening practices that already exist in school districts. This will then assist school districts to develop robust and pedagogically sound educational practices.

In conclusion I suggest that in professional development settings universities, school districts, and teachers use community of practice as a metaphor for analyzing current practices and developing strategies for infusing new practices to a school district. As the works of Barab and Duffy (2000) and Palincsar et al. (1998) suggest, there are limitations for using community of practice as guidelines for designing and developing new learning environments in educational settings. Therefore, in future research there is a need for examining the advantages and shortcomings of using community of practice as a tool for designing and developing educational environments.

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Family Characteristics of Authentic Materials and Activities in Constructivist Learning Environments

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Abstract

*In the constructivist literature, the use of authentic materials and authentic activities as tools of meaningful learning is repeatedly emphasized. Using Wittgenstein's concept of family resemblance as a framework, I conducted an extensive study of the authentic activities and materials used in three elementary classrooms in Des Moines, Iowa. The presentation will be based on analysis of interviews, observations, field notes, and student portfolios using N*VIVO, a qualitative software package. In recent years, educators all around the world have been searching for new approaches to teaching and learning. In both developed and developing nations, many policy makers as well as educators are emphasizing more than ever the importance of education. The constructivist perspective is one valuable response to these concerns about finding alternatives to traditional teaching methods. It is also an area of cutting-edge applied research.*

Introduction

Authenticity, in fact, is one of the main characteristics of constructivist learning environments (CLE). There are many theoretical discussions of authentic learning, and many lists of the theoretical and conceptual characteristics of authentic learning materials and activities. However, there is very little research on the actual characteristics of 'authentic" materials and activities as they are used in real classrooms. Are the actual characteristics similar to or different from the theoretical characteristics described in the literature? This paper addresses this question and compares what I found in the classrooms studied to the theoretical characteristics of authentic learning described in literature. The concept of family resemblance, which was developed by the philosopher Ludwig Wittgenstein (1953, 1958), has been used as a framework for understanding the concept of authentic materials and activities.

The Notion of "Family Resemblance"

This study researches the family characteristics of CLE using the notion of 'family resemblance'. The "family resemblance" concept was developed by Austrian philosopher Ludwig Wittgenstein (1889-1951). In his book Principal Investigations published posthumously in 1953, he discusses language philosophy in detail. In his early studies "he tended to take an essentialist view of common nouns: the view that there must be some common element in all cases in which we apply such a word, something that regulates our use of it for all those cases" '(Brenner 1999, p.23). However, the later Wittgenstein challenged this requirement by describing counterexamples, starting with the noun 'game' (1953):

> "Consider …board games, card games, ball games, Olympic games, and so on… If you look at them you will not see something that is common to all, but similarities, relationships, and a whole series of them at that (PI, #66)."

Here Wittgenstein (1953) makes a straightforward statement of fact: "if we examine those things we call games, we will not find any single property in virtue of which they are called games; instead we find that they are grouped together by a whole series of overlapping similarities akin to family resemblances".

The family resemblance concept of Wittgenstein fits perfectly with constructivist theory and helps orient studies like this one. In this study I was looking for family resemblances, not universal traits. So the features mentioned below are not the common features of all three classrooms I observed all the time. Rather, they are often found, and taken as a group they constitute a set of family resemblances.

Setting of the Study

For this study data were collected in three different elementary school classes. The classes were drawn from two different school districts in the Des Moines, Iowa area. These classes were selected through an extensive process that began with seeking recommendations from professors and school administrators. These sources recommended a large pool of classrooms that were considered "constructivist." I interviewed 15 teachers and observed in their classrooms. Many classrooms were not actually using constructivist teaching strategies and were rejected. Eventually, three were found that regularly used constructivist teaching strategies including authentic instruction. The teachers in these three classrooms were all well known for their regular use of authentic materials and activities, and preliminary observations confirmed this.

There were two teachers from the same school district who participated. Their school uses the Multi-Age Classrooms (MAC) concept. The first teacher (#T1) taught a class with grades 3, 4 and 5 in the room whereas the second teacher (#T2) taught first and second graders in her room. They were both very experienced teachers, and had masters' degrees. The third teacher (#T3) was from another school district and she taught only third graders.

During a seven week period in October, November, and December 2000 I visited these classes each school day. I videotaped all the class time with single digital camera. When conducting the interviews, I also used the video camera with the permission of teachers and parents. After my visits to classes I took field notes on a daily basis in order to clarify the videotapes' content.

Once the data were collected I used NVivo, a popular qualitative data analysis program to code and analyze the data.

Results

Family Characteristics: There are several characteristics of constructivist learning environments in which authentic activities and materials are used regularly. First, teachers use real life materials in order to stimulate deeper understandings. Second, the meaningful learning experiences are the basis of most but not all activities in the three classrooms studied. Third, there are many learning centers in which students practiced hands-on activities. The focus of instruction is on learning in contexts instead of learning in "out of context." All the activities were developmentally appropriate to the cognitive level of students and the teachers helped students adjust activities to their personal levels of development. Thus, these classrooms tended to be what some have termed "child-centered" as well. Technology use and integration in these classrooms was also a very distinguished feature. There were also other characteristics, such as differences in the physical environment or and differences in the teachers' roles which made these classrooms innovative.

Constructivist Theory Versus Constructivist Practice: My observations in classrooms, plus interviews with teachers and students, indicates there is a strong relationship between constructivist theory and practice. Teachers rarely use direct instruction methods which are often criticized by constructivist theorists. Instead, they use a variety of student centered instructional approaches. However, while theorists tend to present the image of constructivist teaching and learning as exclusive, my study clearly shows that the teachers do occasionally use traditional methods such as drills and objective tests. These were used infrequently, but they were used. The teachers, who were aware of constructivist theory and had extensive experience in "teaching constructively," seemed comfortable using traditional methods occasionally. However, these methods did not characterize or define the classroom experiences of students.

Constructivist Methods Versus Traditional Methods to Learning: The classrooms studied are considered good examples of constructivism. However, I regularly observed traditional methods in these learning environments. There may be many reasons for this. Perhaps it is very difficult use constructivist methods all the time. Perhaps teachers are concerned that the traditional expectations of what schools should accomplish, such as high scores on standardized tests, calls for traditional methods. Perhaps it is difficult to collect the resources needed for constructivist teaching. Or, perhaps constructivist teachers still see a place for traditional methods. They have not replaced traditional methods with constructivist methods; they have, instead, made constructivist methods their primary approach and they continue to use traditional methods because they see a place for them in the classroom.

Another reason for limited use of constructivist teaching is the school environment. The third teacher I observed, for example, wanted to do more than she was doing. However, she felt other teachers and her principal had concerns about constructivist approaches. This teacher used the most traditional methods and the fewest constructivist approaches. The other two teachers, who were in schools where innovative teaching was the norm, and where they were encouraged and supported by other teachers and administrators, were much more likely to experiment.

Authentic Materials Versus Instructional Materials: Even though the classrooms studied might be considered as constructivist learning environments which involve the use of authentic activities and materials, I also regularly observed the use of traditional instructional materials. For example, in language arts classes students regularly read storybooks, some of them assigned by the teacher and some selected by students. The activities students engaged in (e.g., reading to other students, finding the meaning of words they do not understand, discussing the story with others) fall within the broad constructivist framework but the storybooks themselves are not necessarily "authentic: materials. However, as stated by Cronin (1993) assuring that all learning materials are "authentic" is not the purpose of authentic learning. Instead it is important to use authentic materials and activities as much as makes educational sense. Thus, the use of authentic materials is as regular but not continuous characteristic of the classrooms studied. Authentic materials are a family characteristic that will be seen some of the time, but not all the time.

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Comparing Teachers' and Parents' Mental Models for Teaching Hearing-Impaired Children to Speak

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Abstract

In order to understand the cognitive and affective roots underpinning the differences between teachers' and parents' teaching approaches for hearing-impaired children, this study proposes a four-level analysis structure (global-level schema, middle-level schema, local-level schema, and prepositional reasoning) to construct and then compare teachers' and parents' mental models for teaching. The outcomes of this comparison reveal many fundamentally different perceptions and attitudes about teaching between teachers and parents, which often result in ineffective communication between the two. Therefore, it is suggested that to improve the effectiveness of instruction between teachers and parents in special education, one needs to understand how teaching exceptional children is mentally represented before any intervention is designed.

Introduction

In special education, while teachers have the expertise of teaching children with special needs, parents, usually unprepared for such a daunting task, are the ones who execute the teaching tasks and help children to learn everyday. Therefore, it is a common practice for teachers to train parents to teach their children. However, the training's ineffectiveness often puzzles the teachers. It is a commonly shared feeling among teachers that teaching parents is more difficult than teaching children because it requires a lot more persuasion, reminding, and rectification to help parents to accept and to internalize the teaching approaches. Parents, on the other hand, often find it difficult to completely accept teachers' approaches. An important reason is that the disparity between being a parent and being a teacher to a child is often concomitant with different perceptions of teaching, which often results in different teaching styles. For example, parents have been observed to incline to provide more intense instruction (Rogoff, Ellis, & Gardner, 1984), to use more controlling and straightforward styles to manage children's activities, and to be more performance oriented (Wertsch, Miick, & Arns, 1984). Moreover, this disparity also exerts a significant impact on the extent to which parents identify themselves with teachers' teaching approaches. Apparently, when factors like parental expectations, responsibilities, relationship with the child, etc. are amalgamated with teaching, parents often develop a different view from teachers. Especially when the child requires special care, the effects of all these factors seem to be intensified; therefore, more divergent teaching styles are expectable. However, surprisingly few studies have been conducted to understand how differently teachers and parents think about teaching children, in particular, with special needs. As a result, questions such as "Why parents ignore teachers' advice?" and "Why teachers have trouble communicating a pedagogical notion to parents?" are left answered. In order to answer these questions, this study intends to delve into teachers' and parents' mental models to present and then to compare how the notions of teaching are internally represented in teachers' and parents' minds.

Mental Models

Although it has been widely adopted and studied by many researchers, there is no consensus of the definition of the term "mental models" (Hong & O'Neil, 1992). In general, the following features of mental models have been described in the literature:

First, mental model are internal representations that we construct in mind for the message or event that we encounter (Norman, 1983; Johnson-Laird, 1983). Such representations should be "essentially problem-oriented, not encyclopedic in nature, and are bound to be incomplete or underspecified" (Sanford & Moxey, 1999, p.74). That is, they present an analogous structure to the represented entities (Johnson-Laird, 1983; 1989) instead of an identical mirror image in our mind.

Second, mental models are explanatory constructs (Johnson-Laird, 1983). Once the internal representation has been created in our mind, it begins to influence the way we see, interact with, and reason about the world (Greeno, 1989; Dutke, 1996), and to make us experience events by proxy (Johnson-Laird, 1983, p. 397).

Third, mental models have computational capabilities (Greeno, 1989; Wilson and Rutherford, 1989). Especially for discourse comprehension, such computational processes are often represented by propositional reasoning (Anderson, 1993; Johnson-Laird, 1983).

Finally, mental models are schema-based (Driscoll, 1994; Dutke, 1996; Rouse & Morris, 1986; Wilson & Rutherford, 1989; Johnson-Laird, 1983). Sanford and Moxey (1999) further argue that the notion of mental model would be void if it is not rooted in background knowledge.

What these features imply is that by mapping the perceived message or entities to our background knowledge, our mind constructs a prior-knowledge interpreted representation of the given message, which not only presents itself as the surrogate reality for the message in our mind, it also formulates the premises under which we reason and make inferences. Given the close link between mental models and schema, to complete the theoretical discussion of mental models, it is important to understand the construct of schema first.

Schema

Originally defined by Barlett (1932) as "an active organization of past reactions, or of past experiences, which must always be supposed to be operating in any well-adapted organic response" (p. 201), schemas have been described as unconscious mental structures (Brewer, 1987) that contain networks of "interrelations… hold among the constituents of concepts in question" (Rumelhart, 1980, p. 34). Essentially, according to Minsky (1975), it is a construct that organizes our prior knowledge in a hierarchical structure that contains networks of nodes and relations. While the top-level nodes are "fixed, and represent things that are always true about the supposed situation" (p. 212), the bottom-level nodes contain automatically assigned default values that stipulate the conditions that the incoming data have to meet in order to be accepted. These default values--the declarative knowledge represented by propositions --function as premises that rule our reasoning processes (Johnson-Laird, 1983). Based on these propositions, people reason in the format of if-then productions, which serve as the building block of human cognitive operations (Anderson, 1983; 1993). Those proposition-based declarative knowledge thus become the joints where the mental model theory dovetail with the schema theory and thus formulate the integrated internal representation through which we perceive and understand the world.

In this study, the integration of schema and mental models is presented by a four-level structure, i.e., global-level schema, middle-level schema, local-level schema, and proposition reasoning, as will be discussed below.

Methodology

All the data were collected in the Children's Hearing Foundation in Taiwan, a non-profit organization that provides free Auditory-Verbal therapy (Auditory-Verbal International, 1991) and audiology services for hearing-impaired children. To answer the question "Given the same aspiration of helping children to learn as effectively and efficiently as possible, and the same teaching strategy (Auditory-Verbal approach), why and how teachers and parents still teach differently?" purposive sampling was used to select and recruit parents on the basis of the following three criteria: (a) they must have attended the CHF's lessons for at least one year; (b) they must be the primary care-takers and committed to the task of teaching their children to speak; and (c) they accept and value the importance of the Auditory-Verbal approach. Three mothers and their corresponding teachers were invited to participate in the study. Information about these teachers, parents, and children is tabulated in Table 1.

Children & mothers	Joey & his mother	Kyle & his mother	Tony & his mother
Age (child /mother)	5 / mid 30	5.5 / mid 30	5 / mid 30
Siblings	Only child	Has a younger brother (also hearing impaired)	Has an elder sister (with normal hearing)
Mother's education	College	College	College
Years in the CHF	2 years and 9 months	1 year	1 years and 6 months
Child's hearing loss	Severe-to-profound / Cochlear Implant	Moderate-to-severe / Wearing hearing aids	Profound / Cochlear Implant
Corresponding teachers	Jill	Karen	Tina
Age	Late 20	Late 20	Late 30
Marriage	Single	Single	Mother to 2 boys
Years in the CHF	3 years	1 year and 6 months	1 years and 6 months
Time with the child	2 years and 9 months	1 years	6 months

Table 1. Background information of the three teachers, three mothers, and three children.

Data collection

After participants were recruited and before any data collection process began, the researcher spent two weeks in the foundation to get acquainted with participants in order to build a mutual trust. Over the span of three months, interviews, observations, and stimulated recalls (Bryan, Bay, Shelden, & Simon, 1990; Anthony, 1994; Clark & Peterson, 1986; Van Noord & Kagan, 1976) were conducted. All of the interviews and recalls were audiotaped, transcribed, and translated from Chinese to English. An external audit (Lincoln & Guba, 1985) was invited to ensure the accuracy of the transcriptions and translations.

Interviews: Two interviews for each participant were conducted: one at the beginning and one at the end of the data collection processes. The interviews were open-ended in nature to elicit a holistic picture of participants' perceptions of teaching.

Observations: For each teacher-parent pair, two therapy sessions at the CHF which contain representative episodes or interactions that evidenced certain thinking processes were videotaped and fully transcribed.

For each mother, two teaching sessions at home were videotaped and fully transcribed. To reduce the intrusion, the researcher and the video camera were far away from the teaching site as much as possible.

Stimulated Recall on Videotapes

After each videotaped session ended, the teachers (for the CHF sessions) and mothers (for CHF and home sessions) were asked to reflect on the videotape right after the sessions ended. The purpose of the stimulated recall was to (a) reconfirm the researcher's observations, (b) allow participants a chance to organize and reexamine what they thought and felt in the sessions, and (c) expose hidden messages that were otherwise not observable in the interactions.

Data analysis

In this study, two types of data were collected: (a) what people did, and (b) what people said. The fieldnoted videotape transcriptions were first broken down into different activity groups, e.g., reading a story. The constituent unit behaviors and their relations within each exchange of verbal or bodily language were first identified, coded, and represented by boxes and arrows. These intra-activity models are called micro-level interaction models. After all micro-level interaction models are completed, patterns of people's launching and reacting to an interaction across different teaching activities emerged. These emerged patterns are thus constructed into inter-activities models, called macro-level interaction models, in the format of flowcharts to represent people's knowledge of conducting a certain teaching procedure. Because this model concerns knowledge of procedures that are directly related to conducting a teaching activity, it constitutes the local-level of the schema of teaching.

After all the interview and recall data were transcribed and verified by the participants, they were first distilled into propositions. As the gradation of their relations to a specific teaching behavior emerged, these propositions were divided into three-level schema to represent the hierarchy of thoughts.

Global-level schema: composed of essential attributes (Wilson & Rutherford, 1989, p. 623) that represent prototype (Hampton, 1991; Medin, 1978) conceptualization of teaching that emerged from data as the quintessential notions of a typical thinking mode that formulates the central tendency of a person's conceptualizing a teaching task in a genuine yet context-free teaching scenario. In reference to Krathwohl's affective taxonomy (Krathwohl, Bloom, & Masia, 1964), this is analogous to the "generalized set".

Middle-level schema: composed of themes or beliefs that were repetitively voiced by the participants as the bottom-line principles that they hold on to as a guidance for reasoning or behaving toward a certain situation. This is corresponding to "commitment" in Krathwohl's affective taxonomy.

Local-level schema: composed of the network of context-bound and teaching-behavior-related propositions that represent the declarative knowledge (Anderson, 1983) of conducting a certain teaching procedure. This local-level schema from verbal data will be matched with the one from observation data (macro-level interaction models) on the basis of corresponding constituent behaviors so that the actions and the knowledge embedded in each action are integrated.

Propositional reasoning productions: as every teaching task-related proposition implies a goal to achieve, which is commonly derived from the global- and middle-level schema, propositions with the same goal are first grouped. The goal serves as the condition, the "if" part, of an if-then production (Anderson, 1993), and these propositions make the action, the "then" part (or counter-examples as pointed out by Johnson-Laird, 1983). These constituent behavior based if-then productions therefore represent the underlying cognitive operations of each teaching behavior.

After analyzed with this framework, the teachers' and parents' mental models for teaching are compared and the most significant differences are presented as follow.

Results

Due to similar training and education backgrounds, a striking consistency was found among the three teachers' data. Therefore, these data were combined as one and compared to the three mothers' individual data on the basis of the four-level mental model framework. However, to avoid redundancy, at the three-level schemas, teachers' and the three mothers' models are compared at the same time; but to reveal the individual differences, the teachers' propositional reasoning models are compared with each of the three mothers' individually. The following are the outcomes of the comparison.

Comparison of Global-Level Schema

The teachers' and the three mothers' global-level schemas--the prototype conceptualization of teaching--are characterized as language-oriented (the teachers), performance-oriented (Joey's mother), activity-oriented (Kyle's mother), and child -oriented (Tony's mother). For the teachers, what all the professional knowledge eventually boils down to is a two-in-one concern: how to improve children's auditory and verbal abilities. While interacting with a child, resorting to all the techniques and strategies at the back of their mind, the teachers' thoughts were entirely anchored on applying the Auditory-Verbal approach to the ongoing interactions to help the child learn. In other words, the prototype conceptualization of the teachers' mental processes was centered on the notion of developing children's auditory and verbal abilities surrounded by the techniques and strategies that realize it. In contrast, the notions that the mothers gravitated toward while interacting with their children were related to what they think they need to do to help their children learn the most effectively and efficiently. For Joey's mother, the thought that dominated her teaching mind was "how to let Joey learn as much and as effectively as possible"; therefore, imitation, correction, and full concentration were the core features of the prototype. For Kyle 's mother, the prototype of the teaching mind centered on "how to stimulate Kyle's reasoning ability in natural interactions". Q & A interactions, modeling correct answers, and conducting various activities were the core features. Finally, for Tony's mother, the prototype of the teaching mind centered on "how to seize the moment to input language expressions for Tony to listen to and learn". Around it, the core features consist of observing Tony's behavior, incessantly input language expressions, and pleasant interactions. These prototypical schemas not only identify the core of different people's reasoning processes, more importantly, they point out the driving forces that shape people's efforts and set the tone for perceiving interactions.

Comparison of Middle-Level Schema

The comparison of the teachers' and mothers' middle-level schemas, i.e., attitudes and values, reveals the following differences.

1. Meaningful interaction: There was a consensus belief among participants that language teaching is meaningful only when children pay attention to it. However, the approaches of getting their attention onto the target language objects varied significantly. The teachers and Tony's mother used rewards to trade for children's attention and cooperation, whereas Joey's mother and Kyle's mother usually resorted to demanding or warning. Such a difference is derived from two assumptions of teaching: (a) teaching is to capitalize on any learning opportunity that the child's attention allows; and (b) teaching is to dictate the desirable learning behaviors that the child should enact.
2. Expectations: The teachers based their expectations for children on their current abilities and took other developmental factors into account. Kyle's mother based her expectations on what she thought to be reasonable for children of Kyle's age to accomplish. Joey's mother based her expectations on what she thought to be necessary for Joey to achieve. Tony's mother closely follows the teacher's lead and based her expectations on the progress that Tony made in learning each individual language target.

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3. Pleasant learning interactions: The teachers and Tony's mother believe that fun and learning can and should go hand in hand, whereas Joey's mother and Kyle's mother would rather separate the two and concentrate on the learning outcomes while in lessons. For Joey's mother, nothing was more important than getting Joey ready for school. She would do anything to push and help Joey improve his language ability, having fun excluded.
4. Productivity in contrast to effectiveness of learning: The mothers shared the same goal of making every lesson as productive as possible; the difference was how to accomplish it. For Joey's mother, being productive means getting more accurate responses from Joey, so she would keep correcting and pushing him until he gave a correct response; for Tony's mother it means striving for more opportunities for conducting verbal interactions with Tony, so she would never stop talking while she was with Tony; and for Kyle's mother, it means more cognitive stimulations for Kyle, so she would constantly ask Kyle questions. The teachers, on the other hand, look for effectiveness besides productivity. The effectiveness that they look for is a good-quality learning process that naturally brings out good learning outcomes in a pleasant and natural learning atmosphere.
5. Time pressure: All of the mothers shared the same eagerness to help their children to learn as fast as possible. In one way or another, they expressed their fear that time with their children was too precious to be wasted on things that do not have direct impact on their children's learning. The teachers empathized with such stress and anxiety, but those emotions were not evidenced in the way they taught in the therapy sessions or interviews. Most of the time, what concerned the teachers was whether or not the child had made progress over time. In contrast, what concerned the mothers was whether or not their children were going to be fine in a mainstreamed school.
6. Begin with approaches in contrast to begin with children: The teachers rooted their thinking about teaching on the teaching approaches and tailored them to meet individual child's learning needs, whereas the mothers began with their assumptions of their children's learning propensities and customized the teaching approaches for their children. The difference is that the former may lose sight on the mismatch between teaching approaches and children's learning behaviors, whereas the later may preclude the children from new effective learning experiences.
7. Professional knowledge in contrast to experience: When the mothers' experiences were at odds with the teachers' professional knowledge, the teachers' advice was often disregarded. It was observed that the mothers were more open to advice regarding technical aspects of the approach which may generate more observable effects such as strategies for stimulating children's speaking and listening abilities than conceptual aspects, such as principles for shaping children's behaviors. Especially when the mothers felt their approaches had led to a certain reasonable success in the past, it was hard for them to take the teachers' advice to their hearts.
8. Natural interactions: While teachers believed that learning naturally accumulates in normal-yet-language-targets-focused interactions, the mothers did not entirely trust the processes, or at least did not regard it as enough. The didactic nature derived from their own educational experiences often led the mothers to address the learning duties that the children had to fulfill during casual interactions. That is, in addition to normal exchanges of language, the mothers expect more specific learning outcomes and emphasize learning efforts such as memorization from the children.

Comparison of Local-Level Schemas

The local-level schemas, represented by networks of teaching actions, were broken down to sub-networks that represent different parts of the entire teaching procedure. Teaching behaviors and the patterns of their relations are compared between the teachers' and the mothers' schemas.

1. Before lessons begin: The atmosphere and settings of the CHF environment are designed to elicit the best learning performance from children. Having come to the therapy sessions for at least a year, the children knew what was going to happen and how they were expected to behave in sessions; therefore they were usually more psychologically prepared for the teachers' activities. In contrast, it was more difficult for the mothers to wait and seize the children's motivated moments and squeezed in language-focused interactions on a twenty-four hours basis. Therefore, sometimes the mothers had to acquire the children's attention by more forceful way.

2. Provide verbal stimuli: Once an activity was chosen, the interactions usually began with a verbal stimulus. Two differences were observed in the way that the teachers and mothers presented the verbal stimuli by the Auditory-Verbal approach. First, given their trust and acceptance of the approach, the mothers did not exercise it as proficient as the teachers did. The reason may be due to negligence or implicit resistance to certain techniques (e.g., a mother said "I didn't provide reinforcers because children need to learn to study independently whether having a reinforcer or not). Second, the teachers have a lot more flexibility in changing materials or activities than the mothers. This is because that the teachers have more teaching resources than the mothers while the mothers have more predetermined teaching objectives for the lessons.
3. Problem-solving processes: Believing that children need to learn to solve problems by themselves, the teachers often intentionally brought children into a problem-bound situation, in which the teachers facilitated the thinking process and carefully associated children's problem-solving behaviors with language. This effort was not observed in the mothers' teaching schema. The mothers either predicted the consequence of children's actions to keep children from making mistakes or told them what to do right after the problem occurred.
4. Incorrect response: The three mothers demonstrated three styles of handling their children's inabilities to respond to stimuli. Joey's mother accepted nothing but accurate responses; therefore, regardless of Joey's motivation level, she would keep asking Joey to try until he could respond correctly. Kyle's mother preferred natural interactions, so she would add only one or two extra clues and then disclosed the correct response quickly. Tony's mother primarily concerned about inputting language expressions for Tony to listen to and learn; therefore, instead of correcting his mistake, she would follow his reaction and verbally describe his response for him. On the other hand, the teachers would break down the stimulus, add extra clues, or repeat the stimulus to help the child understand. Meanwhile, they always checked on the children's motivation levels to avoid building any association between adverse emotions and learning.
5. Non-verbal response: When the children gave non-verbal responses, the teachers and Joey's mother would try to help the children respond verbally. Kyle's mother usually did not notice the difference. She would accept non-verbal responses and comment on the accuracy of the responses. Tony's mother would help Tony to respond verbally only when he had demonstrated the ability of saying it correctly in the past.
6. Intelligibility check and imitation: Upon receiving a verbal response from a child, the teachers and mothers had to check its intelligibility to decide if an imitation was needed. Joey's mother always asked Joey to imitate the accurate words or phrases repetitively until he did it right. Tony's mother only asked Tony to imitate when she knew that he had done it before. Kyle's mother did not ask for imitation very often, but when she did, she would correct her children's tongue positions in addition to having the children listen and imitate. The teachers would ask children to imitate only when children were ready to do it, and only do a few rounds of practice to avoid stressing children out. In addition, visual cues were used when nothing else worked and would be taken away immediately after the pronunciation was correctly made.
7. Reinforcement, expansion, feedback, and turn-taking: All of the participants believed in the effectiveness of reinforcement, so they more or less would give children rewards or compliments when they performed well. The feedback that the teachers and Tony's mother provided in reaction to the child's response included repeating the child's responses and providing evaluation on its accuracy in a positive way. Joey's mother and Kyle's mother usually provided only judgment. With the possible exception of Kyle's mother, all participants wuold try to expand the children's language whenever possible. Turn-taking was a technique that the mothers seldom apply at home.

Comparison of Propositional Reasoning Processes

In order to reveal the differences between the teachers' and the mothers' mental models in detail, each of the three mothers' propositional reasoning processes is compared individually to the teachers'.

Joey's Mother and the Teacher:

1) Academic oriented in contrast to language oriented: If Joey's mother/teachers want to help Joey to keep up with other children in school,
    a) Joey's mother will teach him the academic materials in advance.
    b) The teachers will focus on helping him to establish good language ability first.

2) Push for maximum performance in contrast to leading into best performance: If Joey's mother/teachers want to help Joey learn as much as possible,
   a) Joey's mother will keep talking to him, correct every mistake he makes, and keep pushing for a good imitation until he gets it right.
   b) The teachers will provide motivators to stimulate his learning interests, and conduct language-focused interactions in designed activities or normal daily communications.
3) Demand him to do it right in contrast to help him to do it right: If Joey gives an incorrect response but Joey's mother/teachers believe Joey can and want to help him respond to the question correctly,
   a) Joey's mother will feel unacceptable, raise her voice to demand his full attention, repeat the same question, and be reluctant to provide more clues because she does not like to lower the standard.
   b) The teachers will reexamine his standing in the course of language development and rephrase or provide more clues to help him respond correctly.
4) Make the child to learn effectively in contrast to look for effective teaching for the child: If Joey's mother/teachers want to help Joey to learn effectively,
   a) The mother will create a serious learning atmosphere and demand complete concentration to make him take learning seriously to learn effectively.
   b) The teachers will identify where his attention is at and present prioritized language-focused interactions in a meaningful way to either attract the child's attention or to follow it.
5) Ignore distraction in contrast to capitalize on distraction: If Joey's mother/teachers want to help Joey learn as much as possible but are disrupted by an unexpected incident in a lesson,
   a) Joey's mother will consider the incident as a distraction, and will ignore it and bring Joey's attention back to the planned lesson as soon as possible.
   b) The teachers will capitalize on the incident and associate it with corresponding language expressions.
6) Eliminate the negatives in contrast to capitalize on the positives: If Joey's mother/teachers want to help Joey learn from the mistake he made,
   a) The mother will incessantly correct any mistake he made and resort to punishment to keep him from making the same mistake again.
   b) The teachers will emphasize the correct part of the response, associate it with the desired response, or directly model the correct response when such association does not work.
7) Model solution in contrast to guide thinking processes: If Joey's mother/teachers want to help Joey to learn how to solve a problem,
   a) Joey's mother will verbally or physically model the solution for him to imitate and learn, and expect him to memorize it.
   b) The teachers will provide more visual or verbal cues to help him understand the problem and facilitate the thinking process to guide him to solve the problem successfully.

Kyle's Mother and the Teacher

1) Activity-oriented in contrast to language-oriented: If Kyle's mother/teachers want to help Kyle learn through an activity,
   a) Kyle's mother will primarily focus on the activity itself and try to generate successful outcomes out of it.
   b) The teachers will try to create relationships among people, objects, or the surroundings in the activity to demonstrate different language features.
2) Reading in contrast to meaningful interactions: If Kyle's mother/teachers want to help Kyle learn different language expressions,
   a) Kyle's mother will teach by reading books.
   b) The teachers will associate the language expressions with Kyle's personal experiences
3) Quantity of interactions in contrast to quality of interactions: If Kyle's mother/teachers want to improve Kyle's general language abilities,
   a) Kyle's mother will conduct more language interactions with him to compensate for her relatively unfocused language interactions.
   b) The teachers will conduct language-targets-focused language interactions with him and expose him to an environment abundant with reasonably advanced language features.
4) Make transition to the future in contrast to do what is working now: If Kyle's mother/teachers want to get Kyle to learn,
   a) Kyle's mother will provide no motivators other than verbal encouragement because that is what happens in schools.

    - b) The teachers will either present a motivator in advance or provide reinforcers afterward to elicit good learning behaviors.
5) Memorization in contrast to comprehension: If Kyle's mother/teachers want to teach Kyle a new concept,
    - a) Kyle's mother will describe it for Kyle to listen to and have him memorize it.
    - b) The teachers will provide more visual or verbal cues to bridge the gap between the stimulus and the child's cognitive level, and facilitate the thinking process to guide the child to comprehend successfully.
6) Memorization in contrast to role playing: If Kyle's mother/teachers want to help Kyle learn different language expressions related to different roles,
    - a) Kyle's mother will model the expressions for him to memorize and hope that he practices on his brother.
    - b) The teachers will have the child play different roles and help him learn the language expressions associated with those roles.
7) Warning and punishment in contrast to enticing motivation: If Kyle's mother/teachers want to get Kyle to concentrate on the lesson,
    - a) Kyle's mother will warn him and let him know that she will be mad if he does not behave.
    - b) The teachers will provide motivators or change to a more interesting activity.
8) Combination of approaches in contrast to Auditory-Verbal approach only: If Kyle's mother wants to help her children make an accurate pronunciation,
    - a) Kyle's mother will model the correct pronunciation and its basic elements for him to imitate first, and then correct his tongue position.
    - b) The teachers will help him learn to make accurate pronunciation by associating the sound they modeled for him with the sound he made.

Tony's Mother and the Teacher

1) Need to know the child's progress in contrast to trust the processes: If Tony's mother/teachers want to design activities for Tony to learn something,
    - a) Tony's mother will design activities that begin with commands or questions for him to respond to test how well he understands her.
    - b) The teachers will present abundant language expressions in accordance with his language capabilities to establish his habit of listening.
2) Language learning with top priority in contrast to language learning grounded in integrated child education: If Tony's mother/teachers want to keep Tony staying in an activities so he can learn,
    - a) Tony's mother will keep him from feeling frustrated, tolerate poor manners of learning, and allow him to have more rewards than he deserves so he will enjoy the activities.
    - b) The teachers will teach him how to deal with frustration, fairness, and accept no inappropriate behaviors.
3) Ride on his inappropriate response in contrast to insist the right way to respond: If Tony's mother/teachers want to help Tony learn when he intentionally ignore the accurate response and responding to stimuli the way he wants,
    - a) Tony's mother will forget about the stimuli and tries to associate his incorrect response with corresponding language expressions instead.
    - b) The teachers will first make sure the stimulus has been clearly presented, and second, make sure he learn and demonstrate the association between the stimulus and its appropriate response correctly at least once.

Discussion

While the global-level schema describes the context-free prototype conceptualization of teaching, middle-level schema represents participants' general values about teaching, local-level schema describes the context-specific teaching procedures, and propositional reasoning represents the cognitive computations behind each teaching behavior. Based on this four-level framework, the comparison of three teachers' and three mothers'mental models reveals striking differences. Given the fact that the teachers and the mothers shared the same goal, i.e., to help their children to learn language as effectively and efficiently as possible, and that they all highly value the importance of the Auditory-Verbal approach for their children, what these differences show is that training is not about delivering knowledge but about transforming a cognitive system. If such transformation takes place only at local-level schema, e.g., learning the techniques of the Auditory-Verbal approach but not the attitudes toward the nature of children's learning, the newly learned will be interpreted in accordance with the existing value systems, and the outcomes of such training will often be different than the trainers would have expected. Oftentimes, what matters to a child's learning experiences is not how accurate a teacher or mother can execute a teaching technique, but the subtle facial expressions, pace, tone of speech, bodily language that reflect a person's fundamental attitudes that are conveyed through executing these techniques. While training a subject matter whose application is inseparable of personal attitudes and subjective-decision making, understanding how the subject matter is mentally represented is crucial for the success of the training.

Furthermore, all the descriptions of the teachers' and the mothers' lower level schemas should be viewed in the perspectives of higher level schemas. On the other hand, propositional reasoning, although demonstrated as closely attached to a particular unit behavior, is actually operated on the basis of the whole schema system. Therefore, this four-level framework represent four aspects of the internal representations that we construct for comprehending the encountered entites in an integrated yet dynamic format.

Finally, the comparison outcomes show that, comparing to the mothers, the teachers are more process-oriented, flexible yet prepared, and fun-driven. They believe in enhancing the positive performance and adjusting their approaches to deal with children's lack of progress or learing motivations. With these teaching inclinations as the platform for the langauge-oriented prototypical teaching mind, which sets the direction for cognitivly processing interactions, all the thinking and teaching behaviors gravitate toward building children's auditory and verbal abilities in the way in accordance with Auditory-Verbal approach. On the other hand, the mothers are more outcome/performance-driven, and goal-minded. Joey's mother's performance-oriented teaching mind results in a error-eliminating, negativly reinforcing, highly controlling type of teaching style, which concerns mainly about how accurate Joey's responses are and how serious that Joey's learning attitude is. Kyle's mother's activity-oriented teaching mind result in an activity-abundant yet language-unfocused teaching style, which compensate for less skillfully conducted interactions by increasing the quantity of interactions. On the other hand, Tony's mother's child-oriented teaching mind generates a fun-loving, encouraging, everything-for-langauge-interactions style, which weighs eliciliting Tony's learning motivation over many other equally important developmental concerns. What these differences indicate is that people conceptualize the task of teaching in different ways. They value different aspects or outcomes of teaching, and thus are more open to information that is based on the same predispositions of teaching. Developed from their personal learning experiences, expectations, or maternally instincts, these teaching predispositions constitute the personally-defined optimal teaching package that they believe is for their children. It not only takes a lot of mutual understanding and empathy to make clear what the differences really are about, it also takes a lot of acclimatization to do something different from what they have accustomed to do.

Revealing these background knowledeg-rooted internal representations of teaching is to improve the mutual understanding between teachers and parents. Especially in special education where parents' teaching efforts are crucial for children's development, when the mothers' perceptions of teaching are intricately intertwined with parental expectations, responsibilities, feelings of guilt, and attitudes toward the child's handicap, teachers' unawareness of these background issues may result in totally off-the-mark interactions between teachers and parents. A study of three teachers and three mothers does not bear too much generalization contribution. However, the intricacy and the integrity of mental models could not be demonstrated with reasonable power of representativeness if no lengthy and in-depth qualitative data collection and analysis procedures are conducted. This study intends to propose a framework for representing mental models, and to build three teachers' and three mothers' teaching models as a window for understanding how teaching is conceived during teaching. The next step is to take these information as a given and figure out the way of promoting the effectiveness of interactions between teachers' and parents' models.

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Evaluation of instruction (training): It is NOT optional for professionals (or, who screened the baggage on your flight?)

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SixSigma Performance

Abstract

Training is a technical term, applicable to interventions that result in a performance outcome, however, the term is often used inappropriately to elevate conglomerations of content to training status even though no performance improvement results or is ever likely to result. Myths about evaluation, that it is optional, or too expensive, or somehow unfair to learners (all false statements) persist because of a lack of competence in evaluation skills on the part of a majority of practitioners. Actually evaluation is a critical component in effective and efficient (and therefore cheap in total cost) training, and it is unfair to learners to expect performance improvement on the job unless the training has been proven through rigorous evaluation. The current rates of change in both technical and non-technical arenas, as well as a slowing economy and tightening budgets contribute to a reality where fewer and fewer people can afford to throw away hours of instruction or training on non-functional conglomerations of content. Rigorous, full evaluation is simply not optional for Instructional Technology professionals.

Introduction

Although calls for data in the field of Instructional / Performance technology continue from every direction (e.g. Anglin, et al, 2000; IBSTPI, 1998; Gery, 1999; Merrill, et. al, 1996; Shrock, 1999), the number of publications which include meaningful evaluation is not increasing, and may be decreasing (Werner & Klein, 2000). Evaluation is often considered to be optional or too expensive, or is simply not a part of the project from the beginning. Some customers and clients have been misinformed in the past that evaluation is expensive, or unnecessary, or somehow unfair to the learners (all these assumptions are false). In fact, evaluation is not only *not expensive*, it is the cheapest step in the process and the best practice for all involved. It's also not at all time-consuming if the intervention involves observable, measurable performance outcomes and the practice is sufficient and aligned to those outcomes (inherent in the definition of training, so an intervention without observable, measurable outcomes is simply not training). In fact, the most expensive choice anyone could make is to forego evaluation and release dysfunctional or non-functional interventions that then consume vast amounts of resources in terms of organizational resources, material costs, and learner time and effort. In addition, most unmeasured "training" sets learners up to fail - thus impacting their subsequent learning efforts far into the future.

A case study, utilizing a technology-based intervention to address a need for skill development by new hires in a semiconductor fabrication facility (Fab), is provided to illustrate the evaluation process, including summative evaluation, and demonstrates the necessity for evaluation as well as the total value (costs and benefits) of routine and systematic evaluation of interventions. The application of Level 1 (trainee response) data, Level 2 (posttest performance) data, and Level 3 (on-the-job performance) data to revise the intervention until it functions at the required level to meet the business need are described.

Foundations

Instructional technology is the application of expertise (in the areas of human information processing, learning, performance, cognition, etc.) to solve real-world gaps in skills and knowledge through specially designed interventions. It is this expertise, along with effectiveness and efficiency data from previous interventions, that enables us to develop instruction that works for the target audience. Although it seems to be lost on a large number of practitioners, the profession of instructional technology is rooted in observable, measurable performance outcomes, under conditions where the consequences of failure are serious; after all, the application of learning theory to solve real-world problems effectively and efficiently really took off as experts worked with the military to prepare soldiers to fight and survive in many types of warfare (see Gagne, 1989; Dick & Carey, 1985; Anderson, 1995; National Research Council, 1991).

As we work to improve the performance of others, we must role model performance to business indicators ourselves, and demonstrate that discipline around assessment and accountability are fundamental to continuous improvement. Using our own tools while demonstrating efficiency and effectiveness and performing at least to the levels we demand of others are both critical components of our credibility. Our customers are nearly always held to some level of minimum performance; can you imagine a factory manager who is only measured according to the amount of raw materials going into the factory? For this scenario, actual production of working units is not measured, ever. Training which is not measured according to actual performance outcomes of trainees after training (i.e., training tracked by a body count or attendance, and with opinion surveys) is very analogous to the Factory Manager who is measured only by how much raw material goes into the factory. Our customers and clients deserve better; the standards of our profession demand better (see standards at AECT site, http://www.aect.org and at IBSTPI at http://www.ibstpi.org; consider reviewing the new ISO requirements for training also). It's impossible for measurement to be superfluous, to be expensive in terms of total cost, or be time consuming in terms of total resources. One basic premise of both Total Quality and Continuous Improvement is that, if you can't measure what you're doing then you don't know what you're doing (measurement is critical to improving both process and product; remember, it's possible to change for the worse). This is so very critical because an intervention isn't training because the word training appears in the title. Training is only training if it functions to enable a permanent (or near permanent) performance change that is observable and measurable.

The Premise

There are clearly issues with the present status of the profession of performance or instructional technology. Training is treated as a joke, as a necessary evil, as too expensive or too difficult to do well, and the low expectations of end users (trainees) and performance owners (managers) enable the practitioners to perpetuate content masquerading as training. The same problems have been discussed over and over in the past twenty years of Training & Development (an American Society of Training & Development publication), as well as in articles published inside and outside the field. The complaints are consistent across the years, and are detailed in articles like: Furnham's *Fire the training department*, (1997), Kruger, & Dunning's *Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments* (1999), and Armour's *Big lesson: Billions wasted on job-skills training* (1998), just to name a few. For example, in a USA Today article, Armour (1998) explains provides some insights, "Faced with crippling skill shortages, employers are spending skyrocketing amounts of money training workers. The problem? Many programs just don't work. Billions of dollars are spent on wasteful training courses, experts say . . . $5.6 billion to $16.8 billion is wasted annually on ineffective training programs," and even provides a solution, " . . . experts say businesses should check for results to separate effective programs from costly gimmicks. 'American industry is spending billions and billions on training programs and doing no evaluation of their effectiveness,' says Cary Cherniss, a professor at Rutgers. 'You have to measure it.' "

Case Study

Semiconductor Equipment Operation Training

The intervention was designed to meet a business need; new hires needed skills training to work in a semiconductor wafer Fab. SortSoft was a new station controller software interface for the Schlumberger 9000 (S9K) tester. The SortSoft Computer Based Training (CBT) package is based on a full, real-time simulator of the SortSoft interface, and therefore was expected to reduce certification time for level 1 Technicians in Sort areas across the company, as well as reducing the trainer time (for technician trainers or engineers/equipment owners) and S9K tester (production) time required for training functions.

The project was unique because it was the company's first full, real-time simulator built to run on a PC and supported by a fully-aligned CBT. In addition, concurrent development was required as the training was to be available to support the implementation of the product at each Fab site. The objectives of the training package accurately reflect the certification checklist from the factories. In fact, the team nearly gained approval for the course completion to stand for certification. The equipment owner engineers (those responsible for the operation, up-time, maintenance, training and certification for the equipment they "own") acknowledged the alignment of the training and felt that the posttest did reflect the actual operations skills required. Although several additional alarm sequences were added to the wafer sorting segment of the posttest, the engineers did not accept it as full certification because they wanted to check for themselves that each operator could demonstrate all the skills on an actual tester.

At the time the team began initial design, a checklist was created covering all the skills required for certification on the SortSoft interface. The checklist was used for updating the skills of technicians certified to operate the existing interface at the development facility. That checklist was also used as a basis for another recording instrument; equipment owner engineers were asked to carefully track the time it took to re-train the technicians on the new interface and to train new technicians as well. Seven new technicians were trained at the development Fab, and the recorded times for training new technicians were used as a baseline for comparison in measuring the efficiency of the CBT/Simulator training intervention. It is interesting to note that the equipment owner engineers had previously asked to provide training time requirements by the programmer initially assigned to the project and their responses bore no relationship to the actual times tracked during technician training in the development Fab. One engineer reported training times as much as 50% in excess of the actual time required, all other engineers reported training times more than 50% below the actual time required. The instructional designer, aware of the reliability and value of self-reported data, created the time tracking instrument and carefully communicated the purpose and importance of tracking time spent on training. Although the engineers did not match the specificity of time tracking achieved with the CBT/Simulator intervention, the times reported were more accurate and therefore a meaningful basis for comparison.

Usability / Functionality Testing

Basic usability testing, even for paper-based manuals, precedes any performance testing; functionality testing can easily run concurrently with usability testing. Usability means that people can follow the directions, use the documentation or intervention successfully, not get lost or frustrated while trying to use the materials, and not have trouble figuring out what to do next. Functionality testing means the materials work consistently like they are supposed to: the exercises or practice items are aligned to what the trainees are learning to do and anyone who has completed the instruction should be able to complete most or all of them correctly; the answers as well as steps for successful completion are provided as appropriate feedback when required; scenarios or simulations are provided where appropriate to learning outcomes; and the thing works (application runs, links link, manual is accurate and has complete table of contents, index, and sufficient and accurate instructions/directions to users). Once people can get through it successfully, then a tryout or pilot test will provide critical feedback on effectiveness and efficiency of the intervention.

In the SortSoft case, content experts and the test engineers, using an explanatory guideline and checklist created for that purpose, also reviewed the intervention. In some cases, the equipment owner engineers requested that the content be restructured or reorganized in ways that made it more useful for experts (they themselves) but NOT for the novices who made up the target audience, and those changes were refused (with extensive communication about why).

During usability and functionality testing, we identified necessary revisions. We installed a dialog box to pop-up when the trainee selected **Exit**from the application menu, so a trainee could choose to return to the CBT if they did not actually want to exit the CBT. Also, information and content were presented in a different colored text than actual instructions for using the simulator and directions for completing practice items. Some small instructional changes were made to revise confusing practice items or add detail to feedback at the end of several modules. At the request of the equipment owner engineers, two different alarms which routinely occur during typical wafer processing were added in two the final practice scenario and also into the posttest simulation of three wafer lots.

Most surprising of all was the behavior of all the testers in regard to the interactivity level of the training. Trainees were required to complete each module and correctly complete the related scenarios before continuing on to the subsequent module. Directions at the beginning of the CBT and the beginning of each module explained that clearly. However, every single trainee ignored the requirements for interaction and practice, and simply clicked the Next button until they reached the end of the first module; they were then dismayed to see instructions directing them back to the beginning of the module so they could complete the required interaction with the simulator that provided the practice. To address this astonishing outcome, a short module was designed to introduce these trainees to performance-based training. By requiring them to actually complete a brief simulation of the Log In process (no different than logging into their network) prior to beginning the first module, we began to change their expectations about interactive, performance-based training; they all acquired bad habits from completing electronic page-turners (simple presentations) mis -labeled as training.

The CBT development schedule followed the SortSoft development schedule closely, so after additional tryouts at several sites with members of the target audience, and revisions required by software changes or lessons learned in tryouts, the pilot was scheduled at the newest Fab. The entire population of new hires training for Sort Operations (all shifts) reported to a small computer lab for a dedicated shift, and each completed the CBT/Simulator intervention. Trainees worked at their own pace. Trainees could log out to take breaks as each chose; the total time did not include breaks. Time stamps throughout the program tracked the completion time for each module and each scenario, and all the performance data (answers to questions, selections made when operating the simulator, etc) was also tracked electronically. The completion time varied from 4 hours 10 minutes to 7 hours 50 minutes, with 92% of the trainees finishing in less than 6 hours 30 minutes.

Quantitative (performance) Data

Most quantitative assessments in training involve both skill and knowledge components; these trainees had to know some rules regarding safe and effective operation of the tester itself in addition to knowledge about the operations of the software. The skills section of the posttest utilized the SortSoft simulator, and when the trainee could demonstrate the capability to process three lots of wafers flawlessly while correctly responding to all alarms, the equipment owner engineer conducted the Skills Certification test. The Cert test simply required that the trainee flawlessly sort three lots of wafers while correctly responding to all alarms, although the checklist included the components of that goal in more detail, which enabled engineers to determine areas of failure for those who did not complete the task flawlessly; those components are also part of the SortSoft posttest and performance test.

The standards for the CBT/Simu lator intervention were set so as to align to the actual performance goal in the factory. Each equipment owner reported the same results: for the first time in his/her experience, all of the trainees achieved certification on the first attempt, which they described as a huge saving in their time during the most critical time period when a new wafer Fab is ramping up to begin production.

The Level 2 included both the Posttest and subsequent Fab Certification for each trainee:

Posttest (two sections):

Knowledge – trainee can:

- Select SortSoft's purpose / objective, environment and benefits from a list
- Select the correct description and procedures for SortSoft operations
- Label SortSoft's Main Screen and the information displays
- Access / utilize commands in SortSoft's Menus necessary to perform basic SortSoft tasks
- Recognize SortSoft's alarms and state appropriate responses to each

Skills – trainee can:

- Log in to the tester / SortSoft
- Run a correlation wafer and determine next steps
- Set up the tester for a specified wafer lot and / or probe card
- Introduce a wafer lot
- Modify a wafer lot
- Begin, pause and end testing (with and without saving the data)
- Respond to / resolve typical operations alarms in order to continue or restart testing

As noted, all trainees passed the posttest, and all passed the Certification Test on the first attempt. Initial competency levels, performance consistency, and response to alarms were among the factors listed by our clients when we requested that the equipment owner engineers assess the costs / benefits of the intervention. Two to three shifts (12 hour shifts) were dedicated per trainee for instructor-led training (conducted one-on-one by Technician Trainers or equipment owners), the CBT/Simulator freed up all that time on the part of the Trainer, and all but five or six hours on the part of the trainee, fewer Cert Tests also freed up time for everyone. More importantly, that time was freed up during the most intense times in semiconductor Fab work, the ramping up stage. Equipment owners noted benefits of hands-on training without risking the multi-million dollar S9K tester or the $25,000 probe card used to conduct the sorting tests. Down time, even for training, is an expensive proposition because the Fab is so expensive to operate even aside from the capital costs of the testers. Best of all, according to the engineers, the hands-on training did not subject wafers (nearly complete in fabrication when sorted, and therefore very expensive in terms of processing done) to damage and destruction in the hands of novice trainees.

Unfortunately, however, the engineers had developed such a profound distrust of content and applications mis-labeled as training that we were never able to persuade them to allow the simulator-based posttest to qualify as certification for technicians who passed flawlessly. Even the successful re-certifications of 100% of those trained using CBT/Simulator over the next year was not sufficient to overcome the additive experience of so many bad training experiences. Their responsibility as equipment owners includes expensive equipment and supplies as well as expensive product, and although they enthusiastically acknowledged the success of the training and posttest, they wanted to see trainees perform at required levels before they certified technicians to run the equipment without supervision.

Qualitative (opinion) Data

The CBT/Simulator intervention was very different from the typical electronic application provided to the trainees during New Hiring training (page-turners organized by content experts), and the novelty effect likely contributed to the 100% Level 1 response rate. Also, the Level 1 instrument was very specific to the content of the CBT and to the skills required for the posttest and certification, so there was a clear link between the responses trainees gave and the training they had just completed. Several trainees commented that they appreciated the difference between the generic surveys used for other training and one designed to elicit meaningful inputs for the specific training intervention.

SortSoft CBT Level 1 Description

The Level 1 instrument was specifically designed to measure perceptions of motivation, continuing motivation, satisfaction, and confidence. The survey items were specific enough to both content and skill outcomes to enable revisions where necessary. Not all comments resulted in revisions; for example, trainees consistently complained of too many practice items, that they were required to solve more problems than they needed to in order to acquire the skill. However, during tryouts trainees had consistently failed the posttest performance test on the simulator until we increased the number or complexity of the practice problems. Level 1 data has very little value until it is correlated with Level 2 (performance) data; the opinion of the trainee is irrelevant if there is no measurable, observable improvement in job skill – after all, this is on-the-job training in usually competitive businesses, not entertainment. All of the trainees agreed or strongly agreed to the statements on confidence about their performance in the Fab, and that the intervention provided enough information, instruction and practice. All but one trainee would recommend the training to their colleagues and all but one would choose a CBT/Simulator to learn to operate other Fab equipment. The trainee who expressed a preference for instructor-led training was the trainee who took the longest to complete the intervention; language skills (reading comprehension, specifically) were likely a factor in both the completion time and the preference for instructor-led training.

Trainees responded to a list of items using a 4-point Likert-type scale attached to each: Strongly Agree, Agree, Disagree, and Strongly Disagree; after this much time expended on training so critical to the trainee keeping a job, the trainee can reasonably be expected to have an opinion about each statement (an online, 4-point Likert-type scale was implemented with course release).

The Level 1 data was reported out as counts (the number of trainees who agreed with a statement, the number who disagreed strongly with the statement, etc; all four categories for each statement). I specifically coach my clients to pay attention to how practitioners roll up qualitative data, as descriptive statistics cannot be meaningful for this data. The numbers assigned to the categories (typically 1-4 or 1-5) are arbitrary, or artificially determined, so the categories remain Strongly Agree, etc. You cannot take an average of one Agree and one Disagree, and the distance between Agree and Disagree is not numerically equivalent to the distance between Disagree and Strongly Disagree, nor equal to twice the distance between Agree and Strongly Disagree. Reporting out a mean score for opinion data is just meaningless, and it destroys a practitioner's credibility with anyone who has a basic understanding of measurement.

Level 3 (performance on the job) data was captured subsequently when each S9K operator was successfully re-certified to current specifications at appropriate intervals across the next several years. A summative evaluation conducted after three years yielded a request for one module to be deleted due to a change in procedure for processing wafers. Unfortunately, the only other request made at that time was a request to disable the data tracking and writing functionality as no one was using the data even though these trainees all require training in numerous other areas and the data is valuable for learning about that critical target audience who routinely handles and processes wafers so late in the expensive process.

Conclusion

Without using data from the Level 2 and Level 3 evaluations of the SortSoft CBT/Simulator, we could never have achieved the level of performance described above. In the final analysis, we did a better job of training new technicians than the equipment owner engineers; because ISD applied along with expertise in learning and information processing is more powerful than subject matter expertise alone for training. If we had released the intervention in its initial form, the performance levels of new and retrained technicians would have been affected. The company would have paid a huge price when utilizing less efficient training that required far more technician training time over the years, and using less effective training requiring more technician training time adds higher costs due to more engineer training time and certification time. The costs in damaged equipment and products would be added on also. Overall, it is always cheaper to make the training effective and efficient; instructional technologist time is much cheaper than the long-term costs of bad training for all the trainees who are affected. There are an infinite number of excuses, mostly mythical and all of which result in a lack of accountability for a practitioner. A conglomeration of content, even if carefully formatted, does not constitute training; a batch of information handed out (with or without a PowerPoint presentation) is almost never training in any meaningful sense of the term. In fact, bad training is such a routine occurrence that we had to add a special section teaching trainees to actually complete the interactivity before attempting to continue with the CBT. Good training can even help people become better learners; bad training damages profitability, attitudes, and credibility and causes trainees to develop bad habits.

As professionals, we have a responsibility to deliver what we promise to deliver and what we get paid for. The current rates of change in both technical and non-technical arenas, as well as a slowing economy and tightening budgets contribute to a reality where fewer and fewer people can afford to throw away hours of instruction or training on non-functional conglomerations of content. The consequences of failure are serious; whether the training is for baggage screeners in Boston's Logan airport, or the government employees who help families fill out required forms, or the people who repair combat equipment for Special Forces; the commitment is to ensure learners achieve performance capability. Evaluation is simply not optional for Instructional Technology professionals.

One Thing To Take Away With You

The most important thing anyone practicing in the performance profession can learn is the power of data if applied as part of the continuous improvement cycle. The following paragraph is used with permission of the authors (available at http://www.whidbey.com/frodo/isd.htm) (*emphasis added*):

Perhaps the **greatest strength** of the ISD process is the evolutionary nature of the prescriptive, research-based model itself. While the practice of ISD still retains the strengths of the empirical evaluation and revision cycles, to the extent research and experience permit, it is prescriptive. That is, rather than depending extensively on the test-revision cycle to generate effective instruction in an iterative manner, every attempt is made to incorporate research findings and past experience into the detailed procedures and supporting ISD documentation to ensure that the instruction developed comes as close to the mark as possible the first time. This *improves the validity of the process while also improving reliability*. This has proven to be a *powerful tool* in large scale ISD. In addition, as the process provides more data from the constant evaluation process, the procedures can be continually improved.

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